U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-281 114

Oil Spill and Oil Pollution Reports August 1977-October 1977

California Univ, Santa Barbara Marine Science Inst

Prepared for

Industrial Environmental Research Lab, Cincinnati, Ohio

Jan 78

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA-600/2-78-005

2.

3. RECIPIENT'S ACCESSION NO.
PB281114

4. TITLE AND SUBTITLE
OIL SPILL AND OIL POLLUTION REPORTS
August 1977 - October 1977

5. REPORT DATE
January 1978 issuing date

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
Penelope Melvin, Helmut Ehrenspeck, Elizabeth Sorenson

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Marine Science Institute
University of California
Santa Barbara, California 93106

10. PROGRAM ELEMENT NO.
1NE623

11. CONTRACT/GRANT NO.
R-805052-01

12. SPONSORING AGENCY NAME AND ADDRESS
Industrial Environmental Research Laboratory--Cin., OH
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

13. TYPE OF REPORT AND PERIOD COVERED
Quarterly, Aug-Oct., 1977

14. SPONSORING AGENCY CODE
EPA/600/12

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The August 1977 - October 1977 issue of Oil Spill and Oil Pollution Reports is a quarterly compilation of oil pollution publications and ongoing project summaries. Presented in the report are: (a) summaries and citations of published literature and patents; (b) summaries and status of current research projects; and (c) current oil-related conferences. This report is submitted in partial fulfillment of EPA Grant No. R-805052-01 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the Environmental Protection Agency.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*Bibliographies *Abstracts *Patents *Documents *Research	Oil pollution Oil spill events Oil spill research Oil pollution control Oil pollution patents	13B

18. DISTRIBUTION STATEMENT RELEASE TO PUBLIC	19. SECURITY CLASS *(This Report)* UNCLASSIFIED	21. NO. OF PAGES 291
	20. SECURITY CLASS *(This page)* UNCLASSIFIED	22. PRICE PC-A13/MF-A01

EPA Form 2220-1 (9-73)

☆ U. S. GOVERNMENT PRINTING OFFICE: 1978-757-140/6695 Region No. 5-II

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EPA-600/2-78-006
January 1978

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EPA-600/2-78-005
January 1978

OIL SPILL AND OIL POLLUTION REPORTS

August 1977 - October 1977

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other material relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci, to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin designed to review current scientific and technical publications and research projects in the field of oil pollution. Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. This issue contains summaries of research projects and published information selected from the scientific and technical literature during the period August, 1977 through October, 1977.

The following sections are included in the report:

I. Reports, Publications, and Patents
II. Current Research Projects
III. Current Oil-Related Conferences

The report is submitted in partial fulfillment of EPA Grant No. R805052-01 by the Marine Science Institute, University of California, Santa Barbara, California, under the sponsorship of the Environmental Protection Agency.

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ACKNOWLEDGEMENTS

The authors appreciate the assistance of Mrs. Mary Ankeny and Ms. Kathy Courtney in typing the camera-ready copy of OIL SPILL AND OIL POLLUTION REPORTS. We also wish to thank the personnel of the Science-Engineering Library, University of California, Santa Barbara, for their assistance during the research stages of the project.

INTRODUCTION

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin which reviews pertinent scientific and technical publications and research projects to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, documents, and other materials relating to oil pollution published during the period 1975 to 1977 (Section I); summaries and status of current research projects (Section II); and current oil-related conferences (Section III).

Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. Items in Section I are categorized by seven major subdivisions which are divided into thirty-two specific subject categories. These are presented in the Table of Contents. Patents and patent applications are announced under appropriate subject categories. Subject and author indexes for entries in Section I are provided at the end of the report. A list of the periodicals reviewed in preparing this series appears in the Appendix.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications provided upon request by the principal investigators or performing organization. Notices of research projects were obtained from the Smithsonian Science Information Exchange (SSIE). Entries are arranged according to the same subject categories as in Section I and are ordered by serial number within each subject division. Some of the current projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted and headed by the same serial number as originally reported, followed by the word (renewal). Renewal entries are listed at the beginning of each subject category.

Section III, Current Oil-Related Conferences, contains descriptive information on recently held and upcoming conferences relevant to any aspects of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of conference papers are included. All information for this section was obtained from the periodicals reviewed (Appendix) and from responses to written inquiries concerning the meetings.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following: C, reports, publications, and patents; and R, research projects.

ABBREVIATIONS

atm	atmosphere
bbl	barrel
°C	degrees Centigrade
cm	centimeter
dwt	dead weight ton
EIS	environmental impact statement
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
i.e.	(id est), that is
in	inch
IR	infrared
kg	kilogram
km	kilometers
kn	knot
L	liter
lb	pound
LNG	liquefied natural gas
LOT	load on top
LPG	liquefied petroleum gas
m	meter
mg	milligram
mi	mile
min	minute
ml	milliliter
mm	millimeter
OCS	outer continental shelf
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pH	the negative log of the H ion concentration
ppb	part per billion
ppm	part per million
sp.	species
TLC	thin-layer chromatography
U.S.	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
wt	weight
yr	year
%	percent
/	per
μ	micron
μg	microgram

ACRONYMS

API	American Petroleum Institute
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
UN	United Nations
USCG	United States Coast Guard (DOT)
USGS	United States Geological Survey
USDI	United States Department of Interior
USDA	United States Department of Agriculture
USN	United States Navy

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-1634-77
Untitled. (news brief)
Anon. 1977.
Environment 19(5):26-27.

Oil spills, Crude oil, Fate, Ekofisk blowout

The Phillips Petroleum Company's oil well in the North Sea spilled 75,700 L (20,000 gal.) a day of crude oil for 10 days until it was finally capped on May 1, 1977. It was the largest spill to date in the North Sea, comparable to the 1969 Santa Barbara blowout, with a slick estimated to be 48 km (30 mi) wide and 72 km (45 mi) long. Although the slick was expected to be dispersed by weather and wave action, concern centered on long-range effects such as tarballs that may persist for up to 2 years.

C-1635-77
Untitled. (news brief)
Anon. 1977.
Petroleum Engineer International 49(7):1.

Cost analysis, Ekofisk blowout, Offshore drilling, Offshore exploration, Norway

The cost of the April, 1977, Ekofisk blowout has been assessed at over $130,000,000. One future effect of the blowout is the Norwegian government's postponement of drilling north of the 62nd parallel planned for 1978. Norway has also stopped plans for exploration of 16 blocks to be offered to oil companies this year.

C-1636-77
Untitled. (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(7):149-150.

Pollution control, Oil-water separation, Distillation, Oil discharges, USSR

A recent Moscow conference reported two new oil pollution control measures. All Soviet Black Sea ports now have separating equipment to distill and purify oil effluents from visiting ships. Within the next three years, separators will also be installed in Soviet ships for the purification of oil-polluted discharge water and other waste.

C-1637-77
Untitled. (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(7):149.

Oil spills, Statistics, Sources, North Sea, UK

There were 595 oil spill incidents around Britain in 1976, increasing the 1975 figure of 500 spillages by nearly 20%. The Advisory Committee on Oil Pollution of the Sea 1976 survey cites leaks and intentional dumping from ships as the main sources of pollution, but also notes a serious increase in the number of spills from North Sea off-shore oil fields.

C-1638-77
Untitled. (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(6):125.

Environmental protection, Contingency planning, Arctic Ocean, Canada

Canada's Environmental Protection Service has begun a five year technology program to develop oil spill countermeasures for arctic waters. Research areas will include blowouts, movement of oil spills in ice-covered waters, biological effects, recovery, containment and disposal equipment, and shoreline cleanup. The ultimate goal is a comprehensive contingency plan.

C-1639-77
Untitled. (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(6):125.

Oil spills, Regulations, Oil transfer, Biological effects, Birds, Scotland

Occidental Oil's new terminal on the island of Flotta off Orkney has issued new loading regulations after the April, 1977, spill there. Accepted operating conditions have been lowered from force 10 winds to force 5. The spill, claimed to be due to equipment failure, contaminated 12 km of Scapa Flow shoreline and killed more than 100 birds.

C-1640-77
ARGO MERCHANT DISASTER 'INEVITABLE' (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(6):124.

Argo Merchant spill, Tankers, Liability, Spill cleanup

Alarming facts about the ill-equipped "Argo Merchant" and its negligent command are revealed. The history of its accidents and other mishaps is briefly reviewed. The tanker's owners, Thebes Shipping Company, are attempting to limit their liability for the loss of the ship and to avoid paying compensation for cleanup costs and pollution damage.

C-1641-77
ARGO MERCHANT SPILL DISAPPEARS; SHIP HULL STRENGTHENING URGED. (news brief)
Anon. 1977.
Sea Technology 18(7):26-27.

Argo Merchant spill , Monitoring, Movement, Pollution prevention, Tankers, USGS

In order to improve methods of prediction, USGS scientists have studied the movement of the Argo Merchant spill by use of a buoy dropped into the spill in December, 1976. An MIT professor monitored grounding events of the tanker and has made several suggestions in a recent report for preventing tanker break ups. Also, new methods of oil spill trajectory analysis and their relation to this famous spill were reported at the annual American Geophysical Union meeting.

C-1642-77
BLOWOUT EMERGENCY VESSEL DESIGNED FOR NORTH SEA (news brief)
Anon. 1977.
Offshore 37(8):13.

Pollution control, North Sea, Norway, *Blowouts, *Emergency vessel

Paul "Red" Adair is working with three Norwegians to have this vessel operating by late 1978. He is also setting up a division of his company in Norway to handle oil pollution incidents, and is discussing similar plans with British officials.

C-1643-77
BRAVO
Anon. 1977.
Noroil 5(6):25-27.

Ekofisk blowout, Environmental effects, Production, North Sea

The following factors emerged from the Ekofisk Bravo blowout: a combination of luck and calculation limited the effects of the spill; the political and practical experiences of the blowout will be limited in both time and extent; considerable attention will be directed toward development of oil spill equipment; and production from the Bravo platform will start up later and possibly at a lower capacity than anticipated.

[from Petroleum Abstracts 17(34):#237,226. 1977]

C-1644-77
CREW SET TO CAP FALSE RIVER BLOWOUT (news brief)
Anon. 1977.
The Oil and Gas Journal 75(36):20.

Oil wells, Blowouts, Louisiana, *Gas-wells

A Chevron Oil Co. gas-well in the False River field at Point Coupee Parish, Louisiana, blew out August 31, 1977, after high pressure caused failure of the blowout preventers. A crew from the Red Adair Co. was preparing capping operations, and minimal equipment damage was reported at press time.

C-1645-77
DANGER OF OIL POLLUTION - HOW BIG? (news brief)
Anon. 1977.
Ocean Industry 12(4):164.

Oil spills, Norway, Blowouts, *Prediction

A Shell-sponsored analysis was conducted in an attempt to estimate potential danger from blowouts in waters offshore Norway. After computer analysis of 5,000 possible blowouts, it was concluded that only five percent of a spill (largest estimate 100,000 barrels) would reach the coast, and usually only after two or three weeks allowing time for preparations.

C-1646-77
'DON'T DISTORT THE FACTS' SAY LIBERIAN SHIPOWNERS
Anon. 1977.
Canadian Shipping and Marine Engineering 48(7):22-23.

Tankers, Oil spills, Safety, Economics, *Liberian registry

Flag-of-convenience shipowners have had adverse publicity centered on them following numerous tanker oil spills off the U.S. eastern coastline and elsewhere. The Liberian Shipping Council disclaims 'misleading reporting' by the media and discusses safety standards, economics, taxes, and employment. Apparently an effort is being made to improve the situation.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10422. 1977]

C-1647-77
EKOFISK OIL SPILL (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(6):123.

Oil spills, Fish, North Sea, Ekofisk blowout

A blow-out on the Phillips Bravo 14 platform in the North Sea Ekofisk field on April 25, 1977, pumped an estimated 20,000 tons of oil into the sea over a period of seven days. Norwegian anti-pollution ships were unequipped to deal with the spill initially due to gale force winds. The slick covered 1500 sq. km, threatening several fish species.

C-1648-77
MARITIME WATERS GENERALLY POLLUTION-FREE (news brief)
Anon. 1977.
Water & Pollution Control 115(3):6.

Tar, Oceans, Distribution, Canada, Atlantic Ocean, Sargasso Sea

A survey by the Bedford Institute of Oceanography, headed by Dr. E. Levy, shows that Canada's Atlantic seaboard is generally free from pollution. However, waters from Massachusetts to the West Indies have a small but widely distributed amount of oil pollution, mostly in the form of persistent tar balls. The Sargasso Sea vortex appears to be the center of floating tar pollution in the North Atlantic.

C-1649-77
NEW MARINE INFORMATION SERVICE (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(7):147.

Information systems, Statistics, Pollution control, Offshore development, *Data bank, UK

The Natural Environment Research Council's Institute of Oceanographic Sciences (UK) has set up a Marine Information and Advisory Service to provide data about the marine environment to any organization or private individual. The development of a computerized data bank will include coverage of offshore operations, coastal protection, and pollution control. For further information contact the Publicity Officer, Marine Information and Advisory Service, Institute of Oceanographic Sciences, Wormley, Godalming, Surrey GU8 5UB.

C-1650-77
OIL SPILL POLICY (news brief)
Anon. 1977.
Nature 268(5619):395.

Spill cleanup, Dispersants, UK, *Oil spill policy

The British government has adopted a policy to let oil spills degrade naturally where possible, and to use dispersants only for serious incidents. Plans will be made to deal with spills of 16,000 tons per day offshore, and 1,000 tons per day inshore.

C-1651-77
PUMP STATION MISHAP CLOSES TAPS, TANKERS MILL (news brief)
Anon. 1977.
The Oil and Gas Journal 75(34):60.

Oil spills, Pipelines, Crude oil, Alaska, *Pump station accident

Alyeska Pipeline Service Co. shut down the 1280 km (800 mi) trans-Alaska pipeline again on August 15, 1977, after a sump tank overflowed thirty bbl of crude oil inside a pump station. Head of the Department of Interior's Alaska Pipeline Office, Jack Turner, has cited human error as the cause of the incident.

C-1652-77
RED ADAIR COMPANY TO OPEN BRANCH TO OPERATE IN NORWAY (news brief)
Anon. 1977.
Sea Technology 18(7):26.

Blowout prevention, North Sea, Norway, *Red Adair Co.

The Red Adair Company, Norway, is expected to begin operating a security and prevention station for the North Sea in 1978. Adair will be working in cooperation with three Norwegian companies and will concentrate on the Statfjord Field where high rise Condeep fixed rigs present special difficulties in blowout prevention.

C-1653-77
TAPS GOES BACK ON STREAM, PUMP STATION GEAR SALVAGED (news brief)
Anon. 1977.
The Oil and Gas Journal 75(36):44.

Oil spills, Crude oil, Pipelines, Alaska, *Pump station accident

The latest Alaska pipeline shutdown occurred from August 15 to August 20, 1977, due to a sump tank overflow at Pump Station 9. As a result, Alyeska is following a recommendation to use separate sumps for the pumps and the turbine lube-oil system. Pump Station 8, destroyed in a July explosion, is being rebuilt and equipment repaired.

C-1654-77
ECOFIASCO (editoral)
Bourne, W. R. P. 1977.
Marine Pollution Bulletin 8(6):121-122.

Oil spills, Ekofisk blowout, Spill cleanup, Pollution control, North Sea

The author compiles facts about the April, 1977, Ekofisk blowout on the Phillips Bravo 14 platform in the North Sea. Attention is drawn to a series of apparent mistakes made prior to and during the blowout, and cost estimates for well-capping and cleanup operations are indicated. Questions are raised as to the management of the platform, corrosiveness and physical characteristics of Ekofisk oil, oil toxicity and use of dispersants, and pollution control measures.

C-1655-77
NORTH SEA OIL POLLUTION IN SCAPA FLOW (news brief)
Bourne, W. R. P. 1977.
Marine Pollution Bulletin 8(6):123.

Oil spills, Oil transfer, Tankers, Environmental protection, Surveillance, North Sea

The author reviews a March, 1977, oil spill from the tanker "Nacella" which was loading oil from an Occidental terminal at Flotta in Orkney. Two equipment failures, involving the mooring chain and the single point mooring, were responsible for the spill during bad weather conditions which were claimed to be accepted operating conditions. The incident draws attention to the difficulties found in loading vessels in uncertain weather, the inefficiency of booms, and the limited environmental surveillance covering the North Sea.

C-1656-77
THE URQUIOLA OIL SPILL, LA CORUÑA, SPAIN: CASE HISTORY AND DISCUSSION OF METHODS OF CONTROL AND CLEAN-UP.
Gundlach, E. R., and M. O. Hayes. 1977.
Marine Pollution Pollution Bulletin 8(6):132-136.

Urquiola spill, Fate, Pollution control, Spill cleanup, Coasts, Spain

Details are given of the "Urquiola" oil spill of May, 1976, which spilled 100,000 tons of Persian Gulf crude oil. Most of the oil burned, but nearly one third washed ashore on 215 km of coastline. Over 2000 tons of dispersants were used, but oil control and clean-up operations were generally ineffective, largely due to lack of an oil spill contingency plan.

C-1657-77
OIL SPILLS IN THE ALASKAN COASTAL ZONE, THE STATISTICAL FUTURE
Harrald, J. R., B. D. Boyd, and C. C. Bates. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.1-7. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Oil spills, Oceans, Statistics, Coasts, Alaska

This paper reviews the statistical studies published in recent years regarding the global influx of petroleum hydrocarbons into the oceans in order to inform workers in the field of oil pollution of what these statistical budgets do and do not provide.

C-1658-77
INTERNATIONAL ACTION FOLLOWING THE EKOFISK BLOWOUT (news brief)
Hudson, M. 1977.
Marine Pollution Bulletin 8(6):123-124.

Ekofisk blowout, Environmental protection, Wildlife, North Sea

The British Nature Conservancy Council immediately reviewed contingency plans to protect wildlife following the Ekofisk oil spill. Scientists from England, Norway, and Denmark met to assess consequences, and future meetings are planned for all countries with North Sea coasts.

C-1659-77
JERSEY TO TAX OIL COMPANIES FOR FUTURE CLEANUPS
Janson, D. 1977.
New York Times Jan 7:B2.

Legislation, New Jersey, Spill cleanup, Compensation, Oil industry, *Spill fund

Governor Byrne of New Jersey went to the site of the "Olympic Games" tanker spill in the Delaware River to sign the most comprehensive state legislation in the U.S. regarding spill cleanup and damage compensation. The new law will assess a 1¢/bbl tax for oil brought into the state in order to create a $25 million spill cleanup and compensation fund.

[from Environment Abstracts 7(4):#77-02762. 1977]

C-1660-77
LIBERIAN REGISTERED TANKER SPILLS OIL INTO DELAWARE RIVER - CONSERVATIONISTS SEEK TO CLEAN UP
Janson, D. 1977.
New York Times Jan 5:9.

Tankers, Olympic Games spill, Birds, Spill cleanup, Delaware, *Delaware River

After the tanker,"Olympic Games", ran aground in the Delaware River and spilled 507,000 L (134,000 gal) of oil, volunteers and specialists attempted to save oiled ducks and geese and protect some 60,000 water fowl threatened by 40 km (25 mi) of oil slicks. Indictment of the ship's captain and a lawsuit against the ship's owner were being sought.

[from Environment Abstracts 7(4):#77-02761. 1977.]

C-1661-77
FLAG OF CONVENIENCE OIL TANKERS MAGNIFYING CONCERN ABOUT SPILLS
Kifner, J. 1977.
New York Times Feb. 13:1.

Tankers, Oil spills, *Liberian registry, *Flags of convenience

Recent tanker accidents have aroused national concern over oil pollution and its relation to ships flying flags of convenience. Liberia is at the center of this concern, as Liberian registry offers relatively restriction-free and profitable operation and seems to allow dangerously unsafe ships and their crews to ply the seas and pollute the shores.

[from Environment Abstracts 7(5/6):#77-03182. 1977]

C-1662-77
TANKER LOSSES SET RECORD IN '76 PERIOD (news brief)
Kifner, J. 1977.
New York Times Jan. 10:1.

Oil spills, Tankers, Oceans, Statistics, Tanker accidents

Records for oil tanker losses and the amount of oil spilled were set in the first nine months of 1976 - well before the wreck of the "Argo Merchant" and the following rash of tanker mishaps. Thirteen tankers were declared a total loss, and nearly 200,000 tons of oil were spilled into the world's oceans during that period.

[from Environment Abstracts 7(4):#77-02475. 1977.]

C-1663-77
SPILLAGES FROM OIL INDUSTRY CROSS COUNTRY PIPELINES IN WESTERN EUROPE. STATISTICAL SUMMARY OF REPORTED INCIDENTS, 1975.
King, E. M., and P. Rogier. 1976.
Stichting CONCAWE Report 7. 13p.

Oil spills, Oil transport, Pipelines, Spill cleanup, Europe, *Cross country pipelines

In 1975, cross country pipeline systems in Europe totalled 17,900 km in length, had a combined throughput of 483 million m^3 of petroleum products, and had 20 reported spill incidents, with a total loss of under 400 m^3. The spillage amounted to 0.00008% of the total volume transported. None of the spills took more than one month to clean up, and no known instances of contamination of potable water resources resulted.

[from Environmental Health and Pollution Control 11(9). 1977.]

C-1664-77
EDITORIAL - THE 1977 OIL SPILL CONFERENCE
Kleinman, B. 1977.
Ecolibrium 6(3):1.

Oil spills, Fate, Environmental effects, Spill cleanup, Monitoring, Behavior, *1977 Oil Spill Conference

The 1977 Oil Spill Conference which was held in March, 1977, in New Orleans, was the fifth conference on oil spills sponsored jointly by government and industry. In the first conference in 1969, 41 technical papers were presented; in this most recent meeting, 123 technical papers provided the latest information on the behavior of oil under different environmental conditions, on the known environmental effects of spills, and on procedures useful in preventing, controlling, monitoring, and cleaning up a spill.

C-1665-77
NORTH SEA BLOWOUT TAMED QUICKLY
LeBlanc, L. 1977.
Offshore 37(6):32-33.

Ekofisk blowout, North Sea, Pollution control

The eight day blowout of Phillips Petroleum Company's Bravo platform in the Ekofisk field in late April, 1977, is reviewed, and the successful capping of the well by the Red Adair team of specialists is described in detail. The spill comprised 178,000 bbl of oil, at one point forming a slick approximately 70 km (45 mi) long by approximately 50 km (30 mi) wide.

C-1666-77
Untitled (news brief)
Thompson, G. B. 1977.
Marine Pollution Bulletin 8(6):125.

Dispersants, Fish, Toxicity, Tropical regions, Japan, *Warren Springs Laboratory, *Hong Kong

On January 1, 1978, the Hong Kong Agriculture and Fisheries Department will introduce controls on the use of oil dispersants due to their adverse effects on fish. Toxicity testing is being done and it appears that toxicity classifications determined at the Warren Springs Laboratory (UK) may not be applicable under tropical or sub-tropical conditions.

2. MONITORING

C-1667-77
Untitled. (book review)
Anon. 1977.
Chemical Engineering 84(17):15.

Monitoring, Contaminants, Analytical techniques, Sampling

A brief review of E. D. Goldberg's Strategies for Marine Pollution Monitoring (New York, John Wiley & Sons,1976. 310p) is presented. This book was fostered by a U.S. National Oceanic and Atmospheric Administration workshop, and reviews recent analytical techniques for organic and inorganic substances. Sampling methods and pollutant transport are also included.

C-1668-77
Untitled. (news brief)
Anon. 1977.
Marine Technology Society Journal 11(1):53.

Monitoring, Argo Merchant spill, Chesapeake Bay

Marine Technology Society and American Society of Naval Engineers members attended a recent seminar on oil spills (University of Connecticut at Avery Point, February, 1977). A panel of USCG and EPA scientists observed that virtually none of the Argo Merchant oil spill had sunk below the water's surface. The oil was dispersed, and one slick was sighted 880 km (550 mi) due east of Chesapeake Bay.

C-1669-77
ELECTRICALLY DRIVEN FOAM/WATER MONITOR (product information)
Anon. 1977.
Offshore Engineer 5:98.

Monitoring, Design and engineering, Pollution control

This new remote-controlled monitor, offered by Svenska Skumslacknings, was designed for marine needs and the suppression of oil fires at docks and platforms. There is a choice of voltage and dc or ac for the motors. The circle of movement is 170° and elevation limits are -45° to +85°.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10454. 1977]

C-1670-77
OIL CONTENT MONITOR (product information)
Anon. 1977.
Journal Water Pollution Control Federation 49(7):474a.

Monitoring, Chemical analysis, Oil spills, Waste oil, *IR absorption

Sahkoliikkeiden Oy, a Finnish manufacturer, has designed an oil content analyzing and monitoring system that will report waste spills immediately with direct measurement from the water. The IR absorption technique used is unique in that it does not need recalibration at less than ± 10% accuracy. Contact: Trade Commissioner, Consulate of Finland, One IBM Plaza, Chicago, Ill 60611.

C-1671-77
INPUT OF LOW-MOLECULAR-WEIGHT HYDROCARBONS FROM PETROLEUM OPERATIONS INTO THE GULF OF MEXICO
Brooks, J. M., B. B. Bernard, and W. M. Sackett. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.373-384. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Monitoring, Hydrocarbons, Sources, Platforms, Gulf of Mexico, *Gas venting, *Brine discharge

Dissolved C_1 to C_4 hydrocarbon patterns measured during the last 6 years in the Gulf of Mexico indicate that underwater venting of waste gases and brine discharges, both associated with offshore platforms, are the major sources of non-methane light hydrocarbons to upper Gulf coastal waters. Although these compounds are apparently not toxic to marine organisms, they are proving to be highly sensitive indicators of the most toxic components of petroleum which are entering the sea from man's activities.

C-1672-77
DISTRIBUTION OF PETROLEUM HYDROCARBONS IN WESTERNPORT BAY (AUSTRALIA): RESULTS OF CHRONIC LOW LEVEL INPUTS
Burns, K. A., and J. L. Smith. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.442-453. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Monitoring, Hydrocarbons, Sources, Distribution, Chronic effects, Australia, *_Mytilus edulis_, *Indicator species

The mussel, _Mytilus edulis_, was the major indicator species used to establish problem areas and probable sources of petroleum input. Two major sources of pollution were identified: refinery and other industrial outfalls, and boating activities. Pollution levels varied from no detectable petroleum hydrocarbons to amounts close to saturation levels of body lipids in mussels (29 mg/g lipid). This discussion includes means of relating amounts found in indicator species to level of input and implications on the toxicity to various components of the ecosystem.

C-1673-77
FATE AND EFFECTS OF CRUDE OIL SPILLED ON PERMAFROST TERRAIN. FIRST YEAR PROGRESS REPORT
Collins, C., F. Deneke, T. Jenkins, L. Johnson, and T. McFadden. 1976.
Cold Regions Research and Engineering Laboratory, report CRREL-SR-76-15. 11p.

Monitoring, Fate, Crude oil, Movement, Biological effects, Microorganisms, Chemical effects, Alaska, *Permafrost terrain

This study is concerned with the long-term effects and ultimate fate of crude oil spilled on permafrost-underlain tundra. Two experimental oil spills of 7570 L (2,000 gal) each on 1295 km^2 (500 sq mi) test plots near Fairbanks, Alaska were designed for the project. This report concerns the first one, a winter spill in February 1976; the second spill is planned for the peak growing season in the summer. Monitoring techniques will cover oil movement, temperature regime, biological effects, microbiological changes, permafrost impact, and chemical degradation of the oil.

[from ERDA Energy Research Abstracts 2(15):#37008. 1977]

C-1674-77
DEVELOPMENT OF BUOY MOUNTED HYDROCARBON VAPOR SENSORS FOR USE IN LOCAL AREA POLLUTION SURVEILLANCE SYSTEMS
Goodson, L. H., W. B. Jacobs, S. Dick, and E. T. Fago, Jr. 1976.
Final report, USCG-D-127-76; Contract DOT-CG-34320-A. 50p.

Monitoring, Oil spills, Detection, Design and engineering, *Buoys, *Gas sensors

A low cost system for the rapid detection of small amounts of spilled oil uses two Taguchi Gas Sensors (semiconductor, stannic oxide on a support), one of which responds to oil vapors and engine exhaust. The other sensor is protected by a semipermeable membrane which has little or no effect on the sensor's response to carbon monoxide yet is able to retard its response to hydrocarbon vapors. An alarm is signalled when the uncovered sensor responds and the covered sensor does not.

[from Government Reports Announcements 77(11):#AD-A037 237/5GA. 1977]

C-1675-77
ULTRASONIC POLLUTION MONITOR
Houlihan, T. M., and F. K. McGrath. 1976.
Environmental Technology '76, Philadelphia. 1976. p.487-480.

Monitoring, Pollution control, Oil-water separation, Ships, *Ultrasonic monitor

An ultrasonic oil/water separation and monitoring system has been developed and tested and will be applied toward controlling pollution from naval vessels. The ultrasonic monitor has been found to be effective and to have the necessary degree of sensitivity.

[from Environment Abstracts 7(4):#77-02465. 1977]

C-1676-77
ENERGY-RELATED MARINE DATA MANAGEMENT IN THE PACIFIC NORTHWEST
Hughes, P. 1977.
Environmental Data Service. p.4-11.

Monitoring, Baseline studies, Environmental effects, Offshore development, OCS, Information systems, NOAA, BLM, Alaska Coast

Environmental baselines are being established in the Alaskan Outer Continental Shelf Environment Assessment Program (OCSEAP), run by NOAA's Environmental Research Laboratories and funded by the Department of the Interior's Bureau of Land Management. Details of the data management system provided by the Environmental Data Service are outlined. A similar project - the Puget Sound Energy-Related Project - deals with potential environmental effects of intensified petroleum activities.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10591. 1977]

C-1677-77
INSTRUMENTATION FOR ENVIRONMENTAL MONITORING/VOLUME 2, WATER.
Lawrence Berkeley Laboratory, Environmental Instrumentation Group. 1976. Report LBL-1. 18p. Third update.

Monitoring, Source identification, Chromatography, Design and engineering, *Instrument survey

This survey, originally compiled in 1973 and periodically updated, includes a chapter on oil and grease in water. Information from 1975 includes a laboratory analysis and manufacturer's specifications of seven oil identification instruments (gas chromatographs). It is recommended that the instrument descriptions not be used alone, but in conjunction with the introductory information, the referenced literature, and manufacturers' publications given in this survey.

C-1678-77

SEDIMENT HYDROCARBONS AS ENVIRONMENTAL INDICATORS IN THE NORTHEAST GULF OF MEXICO

Lytle, J. S., and T. F. Lytle. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.404-412. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Monitoring, Hydrocarbons, Sediments, Sources, Gulf of Mexico
*Continental shelf

Hydrocarbons were analyzed in sediments collected from the Gulf of Mexico along the continental shelf from Pascagoula, Mississippi, to Fort Myers, Florida, in an effort to survey the hydrocarbons in this area and detect man-induced seasonal effects in hydrocarbon profiles. Three zones are distinguished by their aliphatic hydrocarbon distribution and are discussed in detail.

C-1679-77

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA

MacLeod, W. D., D. W. Brown, and R. G. Jenkins. 1976.
NOAA Technical Memorandum ERL MESA-8. 59p.

Monitoring, Hydrocarbons, Environmental effects, Oil transport, Pipelines, Refineries, Puget Sound

Hydrocarbon baseline levels must be measured in the title regions in order to assess the potential future environmental impact arising from increased tanker traffic, pipeline transport, and refining operations when the Alaska pipeline comes into operation. This report presents results of a pilot study and offers recommendations for a first year Petroleum Hydrocarbon Baseline Investigation.

[from Selected Water Resources Abstracts 10(14):#W77-06875. 1977]

C-1680-77

OIL POLLUTION COMPLIANCE MONITOR

Moreau, J. O. 1976.
U.S. Patent 3,985,020

Monitoring, Oil discharges, Tankers, Regulations, Design and engineering, Patent

The monitoring system consists of adsorbing an oil sample which is proportional to total oil discharged and rate of oil discharged on a continuously moving lipophilic belt and subsequently analyzing the belt after the voyage has been terminated when required to prove that the tanker has not exceeded ocean pollution requirements.

[from ERDA Energy Research Abstracts 2(11):#25910. 1977]

C-1681-77
EFFECTS OF HIGH DISCHARGE AND AN OIL REFINERY CLEANUP OPERATION ON HEAVY METALS IN WATER AND SEDIMENTS IN SKELETON CREEK
Namminga, H. E., and J. Wilkin. 1976.
Proceedings of the Oklahoma Academy of Science 56:133-138.

Monitoring, Streams, Sediments, Wastewaters, Refineries, Sampling, *Heavy metals

Grab samples of water and sediment were collected for seven months in 1973. After high discharge, heavy metal concentrations decreased exponentially with time. After the refinery cleanup, Cu decreased with time, but Cr, Pb, and Zn were at peak concentrations during the first week. No significant changes occurred in the sediments.

[from Chemical Abstracts 87(6):#43861v. 1977]

C-1682-77
FREE RADICAL OXIDATION PROCESSES IN SEA WATER AND METHODS FOR MONITORING THEM [in Russian]
Simonov, A. I., V. I. Chernyshov, E. S. Lebedeva, and Yu. S. Takuev. 1975.
Materialy Vsesoyuznogo Simpoziuma "Okeanograficheskie Aspekty Okhrany Vod ot Khimicheskikh Zagryaznenii", Moscow, 1974. p.140-145.

Monitoring, Petroleum products, Oxidation, Seawater, *Chemiluminescence

"The experimental data show that the chemiluminescence method is suitable for monitoring free radical destruction of petroleum and phenols in seawater."

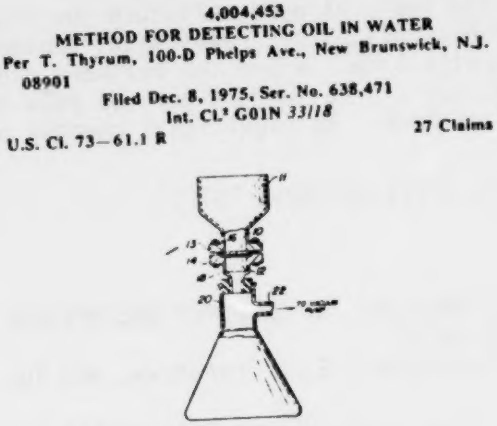
[from Chemical Abstracts 86(22):#160897b. 1977]

C-1683-77
METHOD FOR DETECTING OIL IN WATER
Thyrum, P. T. 1977.
U.S. Patent 4,004,453

Monitoring, Detection, Dispersions, Patent, *Oil soluble dye

To detect oil dispersed in water, a sample of the water is passed upward through a porous filter, the upper end of which contains a pad impregnated with a hydrophobic, oil-soluble dye. A color stain on the visible surface of the pad indicates the presence of oil.

[from Underwater Information Bulletin 9(4):41,#77/08/29. 1977]



4,004,453
METHOD FOR DETECTING OIL IN WATER
Per T. Thyrum, 100-D Phelps Ave., New Brunswick, N.J. 08901
Filed Dec. 8, 1975, Ser. No. 638,471
Int. Cl.^{2} G01N *33/18*
U.S. Cl. 73—61.1 R **27 Claims**

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C-1684-77
DEVELOPMENT OF AN OIL-WATER POLLUTION MONITORING SYSTEM
Tyler, B., W. Gongaware, and T. M. Houlihan. 1977.
Naval Engineers Journal April:125-128.

Monitoring, Ships, Bilges, Design and engineering, Detection

A prototype automatic oil pollution monitor has been built and tested. The monitoring system utilizes the "Direct Difference Method of Total Organic Carbon Determination" and in tests was capable of determining the concentration of any type of oil in a known water sample. This monitoring system is undergoing further testing and development for use in determining oil concentrations of shipboard bilge waters.

C-1685-77
DEVELOPMENT OF AN OIL-WATER POLLUTION MONITORING SYSTEM
Tyler, B. D., and T. M. Houlihan. 1976.
Oceans '76 Conference, Washington, D.C., 1976. p. 12F-17F.

Monitoring, Design and engineering, Bilges, *Total organic carbon determination

The development and testing of an oil pollution monitor using a Direct Difference Method of Total Organic Carbon Determination is reported. With this monitoring system it was possible to specify the concentration of any oil, independent of type, in a known water sample. Applications of the system include monitoring oil concentrations in bilge waters.

[from Environment Abstracts 7(5/6):#77-03173. 1977]

C-1686-77
LEAK DETECTION ON PETROLEUM PIPELINES
Young, H. A. 1976.
International School of Hydrocarbon Measurement Conference, 51st, Norman, Oklahoma, 1976. p.393-398.

Monitoring, Detection, Leakage, Pipelines

A description of the leak detection systems is included along with information on process calculations and process considerations.

[from ERDA Energy Research Abstracts 2(13):#31876. 1977]

3. REMOTE SENSING

C-1687-77
LANDSAT SATELLITES DETECT OIL SLICKS OFF U.S. AND ELSEWHERE
(news brief)
Anon. 1977.
Sea Technology 18(6):31-32.

Remote sensing, Oil slicks, Natural seepage, Pollution control, *Landsat

A USGS Department of the Interior hydrologist, Morris Deutsch, has reported on the detection of oil spills and natural seeps by Landsat images, and discusses the future use of the satelite in the pollution control and offshore exploration. Slicks have been detected since August, 1972.

C-1688-77
SATELLITES DETECT OFFSHORE OIL SLICKS (news brief)
Anon. 1977.
Offshore 37(9):94.

Remote sensing, Oil slicks, Monitoring, Pollution control, *Landsat

Landsat satellites have detected oil slicks off the coasts of the U.S. and other nations, in an Interior Department USGS-managed EROS (Earth Resources Observation Systems) program. The environmental monitoring potential for Landsat is inferred.

C-1689-77
MARKING THE SEA SURFACE WITH ARTIFICIAL SEA SLICKS AND FLUORESCENT DYES TO AID SEARCH AND RESCUE OR OCEAN DUMPING SURVEILLANCE OPERATIONS
Barger, W. R., and W. D. Garrett. 1976.
Final report, USCG-D-107-76. 80p.

Remote sensing, Oil slicks, Surveillance, Oceans, *Dye/slick seamarking device

A new technique of marking the ocean surface with monomolecular films in combination with dyes was studied in order to develop a practical sea marker which can be detected by airborne remote sensing devices in addition to visual observation. A series of mathematical equations was developed to approximate the shapes, sizes, and lifetimes of monolayer slicks under different wind conditions.

[from Government Reports Announcements 77(11):#AD-A037 140/1GA. 1977]

C-1690-77
REMOTE DETECTION OF WATER POLLUTANTS BY COMPUTERIZED LASER-RAMAN SPECTROSCOPY
Brown, C. W. 1976.
Completion report, W77-00154, OWRT-A-054-Ri(1). 31p. PB-258 777.

Remote sensing, Petroleum products, Detection, Chemical analysis, Spectroscopy, *Computerized Raman spectroscopy

Hazardous chemicals in water were analyzed remotely and by conventional instrumentation using digitized Raman spectrometry. In addition, an entirely new method for fingerprinting light petroleum product contaminants was developed. The method involves the removal by chemical extraction of fluorescing petroleum components that obscure parts of the Raman spectrum, and then analyzing the complete spectrum.

[from Scientific and Technical Aerospace Reports 15(11):#N77-20555. 1977]

C-1691-77
USE OF LANDSAT DATA FOR THE DETECTION OF MARINE OIL SLICKS
Deutsch, M., A. E. Strong, and J. E. Estes. 1977.
Offshore Technology Conference, Houston, 1977. 8p.

Remote sensing, Oil slicks, Detection, Monitoring, Coasts, Natural seepage, *Landsat data

Reflectance anomalies associated with oil slicks have been visually detected on film data, by photo-optical enhancement techniques, and by computer processing. Applications of Landsat oil slick data include environmental monitoring of coastal waters and detection of natural seeps, such as in the Santa Barbara Channel, for exploration purposes.

[from International Aerospace Abstracts 17(14):#A77-32244. 1977]

C-1692-77
PROCEEDINGS OF CONFERENCE ON ENVIRONMENTAL QUALITY SENSORS, 2ND, NATIONAL ENVIRONMENTAL RESEARCH CENTER, LAS VEGAS, NEVADA, OCTOBER 10-11, 1973
Environmental Protection Agency. 1976.
EPA/600/9-76/031. 779p.

Remote sensing, Contaminants, Environmental effects, Monitoring, Oil spills

Among the topics covered at the conference are: remote sensing systems for monitoring pollutants; in situ monitoring systems; remote sensing techniques for land use mapping, environmental impact assessment, water surface temperature determinations, and oil and hazardous material spills identification.

[from Government Reports Announcements 77(11):#PB-264 183/5GA. 1977]

C-1693-77
RADAR DETECTION OF OIL CONTAMINATIONS OF THE SEA SURFACE [English summary]
Galayev, Y. M., A. I. Kalmykov, A. S. Kurekin, Y. A. Zementa, B. A. Nelepo, et al. 1977.
Fizika Atmosfery I Okeana 13(4):406-414.

Remote sensing, Crude oil, Petroleum products, Detection, *Sea surface, *Radar

Results are presented of a study on the radiowave reflectance characteristics of a sea surface polluted by oil. Tests were carried out under moderate sea state conditions with radiowaves $\lambda = 3.3$ cm and 10 cm and high coordinate resolution. The presence of oil was found to lead to a reduction of the scattered signal in the area of the spot detection, reaching more than 20 db at $\lambda = 3.2$ cm and more than 18 db at $\lambda = 10$ cm.

C-1694-77
SATELLITE SENTINEL FOR OIL SPILLS IN 1978?
Hovis, W. A., and D. R. Jones. 1977.
Ecolibrium 6(3):4-6.

Remote sensing, Oil slicks, Detection, Surveillance, Natural seepage, Santa Barbara Channel, *Coastal Zone Color Scanner

The limited capabilities of existing satellite remote sensing systems for the detection and monitoring of oil slicks are discussed and contrasted with the much greater capabilities of the proposed Coastal Zone Color Scanner (CZCS), designed to be onboard Nimbus G in 1978. Preliminary tests of the CZCS in high altitude U-2 overflights have demonstrated its capabilities in detecting oil slicks. Further refinement of the system is underway or planned.

C-1695-77
SATELLITE, AIRCRAFT, AND DROGUE STUDIES OF COASTAL CURRENTS AND POLLUTANTS
Klemas, V., G. Davis, J. Lackie, W. Whelan, and G. Tornatore. 1977.
IEEE Transactions on Geoscience Electronics Vol. GE-15:97-108.

Remote sensing, Oil slicks, Coasts, Movement, Wastewaters, *Current circulation, *Satellite-aircraft-drogue studies

A satellite-aircraft-drogue approach employs remotely tracked expendable drogues together with satellite and aircraft observations of waste plumes and current tracers such as dyes or suspended sediment. Tests indicate that the approach provides a cost-effective means of studying current circulation, oil slick movement, and ocean waste dispersion under a wide range of environmental conditions.

[from International Aerospace Abstracts 17(12):#A77-30004. 1977]

C-1696-77
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE. 2. DAMPING OF WATER WAVES BY AN OIL LAYER AS A POSSIBLE INDICATOR FOR SLAR OBSERVATIONS
Pronk, A. C. 1975.
Ph.D. thesis, NIWARS-Publ-22; NTIS No. HC A02/MF A01. 12p.

Remote sensing, Oil slicks, Oceans, *Wave damping, *Oil properties

The damping action of oil pollution on sea waves is discussed in regard to observation from the air. Oil layers of all thicknesses damp a part of the wave spectrum, but only in thicker layers is the damping related to the nature of the oil. The distance over which the sea waves damp out after an oil slick has entered seems a useful indicator for the oil properties.

[from Scientific and Technical Aerospace Reports 15(14):#N77-23583. 1977]

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C-1697-77
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE. 1. REVIEW OF REMOTE SENSING METHODS EMPHASIZING RADAR
vanKuilenburg, J. 1975.
NIWARS-Publ-21; NTIS No. HC A03/MF A01. 29p.

Remote sensing, Oil slicks, Oceans, Bibliographies, *Radar, *Sea surface

The remote sensing methods applicable to the monitoring of oil pollution are reviewed. A discussion is presented on radar observations of oil slicks and of the surrounding sea surface, and a selected bibliography is included.

[from Scientific and Technical Aerospace Reports 15(14):#N77-23582. 1977]

4. SAMPLING

C-1698-77
SEASONAL VARIATIONS OF HYDROCARBONS IN THE WATER COLUMN OF THE MAFLA LEASE AREA
Calder, J. A. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.432-441. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Sampling, Hydrocarbons, Seawater, Chemical analysis, Oil-gas leasing, Gulf of Mexico, *Seasonal variations, *MAFLA lease area

A series of 15 stations in the Gulf of Mexico were occupied during summer, fall, and winter 1975-76. Samples were collected and analyzed by gas chromatography for dissolved hydrocarbons and those associated with suspended particulate material. This report represents the initial evaluation of the three data sets.

C-1699-77
CHEMICAL CARCINOGENS IN THE MARINE ENVIRONMENT I. BENZO(A)PYRENE IN ECONOMICALLY-IMPORTANT BIVALVE MOLLUSCS FROM OREGON ESTUARIES
Mix, M. C., R. T. Riley, K. I. King, S. R. Trenholm, and R. L. Schaffer. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 421-431. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Sampling, PAH, Detection, Mollusks, Carcinogens, Estuaries, Oregon, *Bivalves

Benzo(a)pyrene (BAP) levels were determined in economically-important indigenous shellfish populations from several sites in five Oregon bays. Detectable levels of BAP were present in bivalves from 43 of the 44 sampling sites. High levels (> 15 ng/g) were present in mussels collected from the Newport bayfront in Yaquina Bay and from a marina in Tillamook Bay. Significant levels (> 5 ng/g) were present in *Mya arenaria* collected along the shipping docks in Coos Bay.

C-1700-77
PELAGIC TAR AND PLASTIC IN THE GULF OF ALASKA AND BERING SEA: 1975
Shaw, D. G. 1977.
The Science of the Total Environment 8(1):13-20.

Sampling, Tar, *Plastics, Distribution, Gulf of Alaska, Bering Sea

Seventy-one tows of 740 m^2 were made in search of pelagic tar and plastics in the Gulf of Alaska and Bering Sea from October, 1974 to October, 1975. The abundance of these substances was found to be substantially lower in the Gulf and Bering Sea than in most other oceanic areas for which values are reported. The tar collected in this study is generally more extensively weathered than typical North Atlantic tar as indicated by $N_{1/2}$ values.

5. ANALYSIS

C-1701-77
APPARATUS AND METHOD FOR DETERMINATION OF THE RESIDUAL OILS AND/OR OIL CONTENT IN WATERS
(A. Essers Company) 1977.
German Offenlegungsschriften (unexamined patent application) 2,532,869

Oil-water separation, Detection, Analytical techniques, Patent, *Oil-in-water, *Fluorescence

Petroleum ether or hexane is used to extract the oil from water, and the extract is transferred to a measuring cup containing nonhygroscopic silicic acid gel, a fluorescence indicator. A technique is described for measuring the intensity of fluorescence of the sample and comparing [illegible] with a standard.

[from Chemical Abstracts 86(26):#194672q. 1977]

C-1702-77
THE USE OF LASER RADAR FOR DETERMINING THE POLLUTION OF THE SEA SURFACE BY OIL PRODUCTS [in Russian]
Abramov, O. I., V. I. Evemin, L. I. Lobov, and V. V. Polovinko. 1977.
Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana 13: 331-334.

Contamination, Oceans, Petroleum products, *Laser radar, *Sea surface

Backscattering spectra were obtained under laboratory conditions and for the Bosphorus region using a laser emitting at a wavelength of 0.3472 μ These spectra were used to determine the thickness of oil-product films on water surfaces.

[from International Aerospace Reports 17(16):#A77-35475. 1977]

C-1703-77
ASSESSMENT OF OIL PRODUCT CONCENTRATIONS IN THE OIL FILM FLOATING AT THE SEA SURFACE [English summary]
Anufrieva, N. M., A. B. Gornitsky, M. P. Nesterova, and I. A. Nemirovskaya. 1976.
Okeanologiia 16(2):255-258.

Oil slicks, Chemical analysis, Petroleum products, Seawater, *Sorbents

Tests have been made on various types of sorbing materials suitable for the determination of oil product concentration in surface oil films. Polyurethane plastic has given the best results. Carbon tetrachloride will extract oil products from the sorbent, and quantitative determination of the product is made by the IS-method.

[from Oceanographic Abstracts and Bibliography - Deep-Sea Research 24(1):28. 1977]

C-1704-77
CHARACTERIZATION OF SEDIMENTS IN THE VICINITY OF OFFSHORE PETROLEUM PRODUCTION
Bean, R. M., J. W. Blaylock, E. A. Sutton, R. E. Wildung, and F. M. Davidson. 1977.
Chemistry of Marine Sediments. T. F. Yen (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p.55-72.

Chemical analysis, Sediments, Offshore production, Venezuela, Statistical analysis

"Sediment samples from Lake Maracaibo, Venezuela were fractionally extracted, the fractions were analyzed for C, H, N, and S, and the molecular weights were detected. Statistical approaches were used in interpreting the results."

[from Chemical Abstracts 86(26):#192138w. 1977]

C-1705-77
CHARACTERIZATION OF VOLATILE HYDROCARBONS IN FLOWING SEAWATER SUSPENSIONS OF NUMBER 2 FUEL OIL
Bean, R. M., and J. W. Blaylock. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.397-403. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Fuel oil, Chemical analysis, Seawater, Chromatography, *Water-soluble fraction

Dilute suspensions of No. 2 fuel oil in seawater (less than 1 mg/L) have been analyzed for monocyclic aromatic hydrocarbons using helium partition gas chromatography. Results from the gas chromatograms indicate the existance of soluble and insoluble oil phases in suspensions of No. 2 fuel oil in seawater and the presence of monocyclic aromatic components largely in true solution.

C-1706-77

CHEMICAL CHARACTERIZATION AND MONITORING STUDIES OF THE EFFLUENTS FROM EMERGING FOSSIL FUEL PROCESSES

Clark, B. R. 1976.
EPA-IAG-D5-E681; Contract W-7405-ENG-26. 9p. Air Pollution Control Association Specialty Conference, Cambridge, 1976.

Wastewaters, Refineries, Fossil fuels, Analytical techniques

Approaches to the chemical characterization of aqueous wastes and gas phase fugitive emissions are reported. Specific studies have included characterization of aqueous by-products from oil shale retorting, coal liquefication, and petroleum refining.

[from ERDA Energy Research Abstracts 2(10):#23950. 1977]

C-1707-77

ELECTROANALYTICAL ESTIMATION OF SEAWATER POLLUTION BY AROMATIC HYDROCARBONS

Cosovic, B., V. Zutic, T. Zvonaric, and Z. Kozarac. 1976.
Rapports et Procés-Verbaux des Réunions Commission Internationale Pour l'Exploration Scientifique de la Mer Méditerranée 23(7): 57-58.

Chemical analysis, Aromatic hydrocarbons, Seawater, *Electrochemical analysis

Electrochemical methods, based on adsorption effects at mercury electrodes, present a rapid and simple technique for estimating the concentration of total oil pollutants in seawater. This report describes the methods and discusses test results which indicate that the presence of dissolved aromatic hydrocarbons is responsible for the observed adsorption phenomena.

C-1708-77

HYDROCARBONS IN EASTERN CANADIAN MARINE WATERS DETERMINED BY FLUORESCENCE SPECTROSCOPY AND GAS-LIQUID CHROMATOGRAPHY

Keizer, P. D., D. C. Gordon, Jr., and J. Dale. 1977.
Journal of the Fisheries Research Board of Canada 34(3):347-353.

Hydrocarbons, Chemical analysis, Chromatography, Spectroscopy, Detection, Canada, Atlantic coast

The title methods were used to analyze and quantify hydrocarbons from coastal waters off eastern Canada. Concentrations of n-alkanes ranged from <20 ng/L to about 1 µg/L at depths of 2 and 50 m, respectively. Based on fluorescence analyses, oil concentrations were estimated to range from 0.2 to 9.3 µg/L, with the highest concentrations found in Bedford Basin off Nova Scotia. Hydrocarbons in other areas appear to be principally biogenic in origin.

C-1709-77
DETERMINATION OF ORGANIC POLLUTANTS IN WATER, AS A PART OF ENVIRONMENTAL PROTECTION [English summary]
Kubelka, V., J. Mitera, J. Novak, and J. Mostecky. 1977.
Chemicke Listy 71(3):241-284.

Hydrocarbons, Surfactants, Chemical analysis, Detection, Contaminants, Environmental protection

"A review with 348 references, of the concentration (by extraction or adsorption) and detection of some organic compounds such as petroleum hydrocarbons, surfactants, pesticides, and phenols in polluted water ."

[from Chemical Abstracts 87(2):#11177k. 1977]

C-1710-77
ANALYSIS OF PETROLEUM TYPE HYDROCARBONS IN MARINE SAMPLES USING GAS CHROMATOGRAPHY AND MASS SPECTROMETRY

Laseter, J. L., and M. C. Legendre. 1976.
Oceans '76 Conference, Washington, D.C., 1976. p. 23C-27C.

Hydrocarbons, Chemical analysis, Chromatography, Spectrometry, Zooplankton, Crustaceans, Sediments

Following their extraction with a series of organic solvents, hydrocarbons from zooplankton, shrimp, and sediments are fractionated by column chromatography, resolved by high resolution gas chromatography, and identified by combined gas chromatography-mass spectrometry. Capillary columns enable almost complete resolution of the petroleum-based isoprenoids and branched and cyclic alkanes.

[from Environmental Abstracts 7(5/6):#77-03178. 1977]

C-1711-77
HYDROCARBON ANALYSIS OF SURFACE SEAWATER AND BEACH SAND BY INFRARED ABSORPTION METHODS
Lee. W. T. 1976.
Dissertation Abstracts International B 37(10):5110-5111.

Analytical techniques, Hydrocarbons, Seawater, Beaches, Spectroscopy, Chromatography, Absorption

Infrared spectroscopy was used for quantitative and qualitative determination of hydrocarbons in the marine environment. Gas and thin-layer chromatography were also used for characterizing and separating the samples. Paraffins, aromatics, and olefins were found with evidence of seasonal variance, although the total concentration was usually less than 0.1 ppm. Results indicated that hydrocarbons occur at low concentrations in the presence of other extractable substances, pollution is higher during the colder, winter months, and a positive correlation with boating traffic could not be made.

C-1712-77
IDENTITY, ORIGIN AND DEVELOPMENT OF OFF-FLAVORS IN GREAT LAKES ANADROMOUS FISH
Lindsay, R. C. 1977.
Wisconsin Department of Natural Resources, Madison Completion Report for Project AFC-13. PF-89-304. 7p.

Sources, Contamination, Fish, Chemical analysis, Petroleum products, Great Lakes

The project has consisted of the chemical identification of volatile compounds present in Great Lakes salmon and environmentally related materials. Analytical procedures are described. The occurrence of a number of aromatic hydrocarbons along with the aliphatic even-carbon numbered hydrocarbons would strongly suggest salmon pick-up of oil or petroleum-based product contamination of materials.

[from Selected Water Resources Abstracts 10(14):#W77-06931. 1977]

C-1713-77
INTERTIDAL SEDIMENT HYDROCARBON LEVELS AT TWO SIGHTS ON THE STRAITOF JUAN DE FUCA
MacLeod, W. D., Jr., D. W. Brown, R. G. Jenkins, and L. S. Ramos. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977 p.385-396. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Sampling, Hydrocarbons, Sediments, Analytical techniques, Intertidal zone, Washington

The primary objective of this study was to test analytical techniques for their utility in processing large numbers of marine sediment samples. Solvents/slurry extraction, silica gel chromatography, and glass capillary GC were adapted for analyzing the abundance and variation of hydrocarbons in intertidal sediments from 2 similar sites on the Strait of Juan de Fuca. Results are presented.

C-1714-77
STATE-OF-THE-ART CHROMATOGRAPHIC TECHNIQUES APPLIED TO THE ANALYSIS OF HYDROCARBONS IN MARINE TISSUE
May, W. E., S. A. Wise, S. N. Chesler, B. H. Gump, and H. S. Hertz. 1976.
American Chemical Society. Division of Environmental Chemistry. Preprints of Papers 16(2):55-57.

Chemical analysis, Chromatography, Spectroscopy, Detection, Hydrocarbons, Marine organisms, Baseline studies

A method for detecting hydrocarbons at submicrogram/kilogram levels has been developed and will be especially applicable to pollution baseline and monitoring studies. The method consists of extracting from the tissue homogenate the volatile organic components, followed by liquid chromatographic separation of the biogenic components extracted, gas chromatography quantitation, and gas chromatography-mass spectroscopy identification of the petroleum hydrocarbons. Test results for aromatic and aliphatic hydrocarbons are discussed.

[from Pollution Abstracts 8(4):#77-03382. 1977]

C-1715-77
HYDROCARBONS IN MARINE ORGANISMS [English summary]
Mironov, O. G., and T. L. Shchekaturina. 1976.
Gidrobiologiya Zhurnal 12(6):5-15.

Chemical analysis, Sources, Hydrocarbons, Marine organisms, Chromatography, Spectroscopy, Spectrometry

The use of gas-liquid chromatography, infrared spectroscopy, and mass-spectrometry in the discrimination of biogenic from petroleum hydrocarbons is described.

[from Applied Ecology Abstracts 3(6):#3D7193. 1977]

C-1716-77
DETERMINATION OF PETROLEUM PRODUCTS IN SEAWATER [in Russian]
Nemirovskaya, I. A. 1975.
Materialy Vsesoyuznogo Simpoziuma "Okeanograficheskie Aspecty Okhrany Vod Khimicheskikh Zagryaznenii", 1st, Moscow, 1974. V. I. Chernyshov (ed.). Moscow, Akad. Nauk SSSR, Okeanograficheskie Komissiya, 1975. p. 107-115.

Petroleum products, Seawater, Analytical techniques, *Gravimetric analysis, *Spectrophotometry

Gravimetric and spectrophotometric methods for the determination of petroleum products in seawater are described.

[from Chemical Abstracts 86(24):#176950z. 1977]

C-1717-77

APPLICATION OF GLASS CAPILLARY COLUMNS TO MONITOR PETROLEUM-TYPE HYDROCARBONS IN MARINE SEDIMENTS

Overton, E. B., J. Bracken, and J. L. Laseter. 1977.
Journal of Chromatographic Science 15(5):169-173.

Chemical analysis, Chromatography, Hydrocarbons, Aromatic hydrocarbons, Monitoring, Sediments, *Glass capillary columns

An analytical method is presented which combines the use of high resolution glass capillary columns and gas chromatography for the analysis of hydrocarbons in marine sediment samples. The method resolves almost all of the petroleum alkanes and many of the important aromatic hydrocarbons and permits the distinction between biogenic and petroleum hydrocarbons.

C-1718-77

ANALYTICAL ASPECTS OF OIL IN WATER

Peake, E. 1976.
Alberta, Canada, University of Calgary, The Environmental Sciences Centre. 1976. Publication No. 76-37. 13p.

Chemical analysis, *Oil in water

Summary not available.

[from Environmental Sciences Center, Kananaskis, University of Calgary, Alberta. IB#24. June 30, 1977]

C-1719-77

RESULTS OF PRELIMINARY STUDIES ON THE CHEMISTRY OF COMMERCIAL OIL-SPILL DISPERSANTS

Penrose, W. R., and L. L. Dawe. 1976.
Manuscript Report Series Fisheries Research Board of Canada, No. 1352. 13p.

Dispersants, Chemical analysis, Surfactants

Oil spill dispersants consist of a nonionic surfactant dissolved as a 10-30% solution in a solvent which may be a hydrocarbon, alcohol, or water depending on the surfactant. This report discusses methods for chemical analysis of dispersant surfactants and details the constituents of oil spill dispersants.

[from Aquatic Sciences & Fisheries Abstracts 7(5):#7Q5951. 1977]

C-1720-77
INVESTIGATION OF THE OPTICAL EMISSION OF THE SEA [in Russian]
Polovinko, V. V. 1976.
Geodeziia i Aerofotos'emka No. 6:109-114.

Contamination, *Optical emission, Caspian Sea, Analytical techniques, *Sea surface

Described is an experiment conducted during March, 1975, to determine the relation between the optical emission of the Caspian Sea and the turbulization and pollution of the sea surface by oil. The measuring instrumentation used and results obtained are elaborated.

[from International Aerospace Reports 17(16):#A77-35698. 1977]

C-1721-77
OPREDELENIE NEFTEPRODUKTOV V POCHVE (title not translated)
Potapov, M. P., and L. A. Lukas. 1976.
Gigiena i Sanitariya No. 9:71-72.

Petroleum products, Soil, Chemical analysis

A method for the determinination of oil products in the soil was developed and tested under practical conditons. The procedure is described in detail.

[from Pollution Abstracts 8(4):#77-03938. 1977]

C-1722-77
THE CHEMISTRY OF MARINE PETROLEUM SEEPS
Reed, W. E., and I. R. Kaplan. 1977.
Journal of Geochemical Exploration 7(2):255-293.

Chemical analysis, Natural seepage, Biodegradation, Weathering, Chromatography, Spectrometry, Santa Barbara Channel, Southern California

The occurrence and chemical properites of marine petroleum seeps are reviewed, focusing on those of the Santa Barbara Channel and other parts of the Southern California Borderland. The compositional changes due to weathering by microbial and chemical degradation, evaporation, and dissolution are summarized. The compositions of petroleum seeps are reported based on analysis by gas chromatography and gas chromatography-mass spectrometry, stable isotope studies, and carbon isotope analysis.

C-1723-77
THE FOUNDATIONS OF ORGANIC POLLUTANT ANALYSIS
Rosen, A. A. 1976.
Identification and Analysis of Organic Pollutants in Water.
Ann Arbor, Michigan, Ann Arbor Science Publishers, 1976. p.3-14.

Chemical analysis, Oil spills, Source identification

The development of the field of systematic analysis of organic pollutants, which began about 25 years ago, is described. Among the methods first used in pollutant analysis was passive labeling for the identification of oil spill sources.

[from Government Reports Announcements 77(12):#PB-265 309/5GA. 1977]

C-1724-77
COMPARISON OF TWO METHODS FOR OIL AND GREASE DETERMINATION
Short, J. W., S. D. Rice, and D. L. Cheatham. 1976.
Assessment of the Arctic Marine Environment. Selected Topics.
Fairbanks, Institute of Marine Science, University of Alaska,
1976. Chapter 28. p.451-462.

Crude oil, Fuel oil, Analytical techniques, *Oil-grease determination

The authors compare oil content measured by the gravimetric method (used by government agencies for determining levels of oil in discharged waters) with oil content determined by infrared spectrophotometry for toxic water-soluble fractions of two crude oils and a fuel oil. Recovery of all the oils and a synthetic grease standard was 100% by the infrared method. Using the gravimetric method, recovery of the grease standard was 98%, but recovery of the three pure oils ranged from 52 to 65%. It is concluded that the gravimetric method is sensitive only to heavier compounds of the oils.

C-1725-77
INTERLABORATORY CALIBRATION FOR THE ANALYSIS OF PETROLEUM LEVELS IN SEDIMENT
Wise, S. A., S. N. Chesler, B. H. Gump, H. S. Hertz, and W. E. May. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.345-350. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Sediments, Analytical techniques, Chromatography, Spectroscopy, *Intercalibration

A sample was analyzed by NBS and one other laboratory in order to determine the suitability of Katalla River sediment for a more extensive intercalibration exercise. As a result of the data obtained, an enlarged intercalibration was initiated, which is currently in progress. Comparison of the interlaboratory data should provide a measure of the analytical variability among the participating laboratories.

C-1726-77
ELECTROCHEMICAL DETERMINATION OF SURFACE ACTIVE SUBSTANCES IN NATURAL WATERS. ON THE ADSORPTION OF PETROLEUM FRACTIONS AT MERCURY ELECTRODE/SEA ATER INTERFACE.
Zutic, V., B. Cosovic, and Z. Kozarac. 1977.
Journal of Electroanalytical Chemistry & Interfacial Electrochemistry 78(1):113-121.

Petroleum products, Hydrocarbons, Seawater, Surfactants, Chemical analysis, Adsorption, *Electroanalysis

Dissolved petroleum products in seawater are investigated through electroanalytical techniques. Two methods are used for measuring the adsorption effects of petroleum products and of individual hydrocarbons. Both techniques are discussed in relation to the total surface activity of a seawater sample and the effect of surfactants.

[from Chemical Abstracts 87(4):#28755v. 1977]

6. SOURCE IDENTIFICATION

C-1727-77
PETROLEUM IDENTIFICATION BY LASER RAMAN SPECTROSCOPY
Ahmadjian, M., and C. W. Brown. 1976.
Analytical Chemistry 48(8):1257-1259.

Source identification, Crude oil, Fuel oil, Petroleum products, Analytical techniques, Spectroscopy

The Raman spectra of No. 2 fuel oils, kerosenes, lubricating oils, weathered oils, and actual spill oils were measured. It was found that Raman spectroscopy provides a fast and simple method for identifying petroleum products.

[from Government Reports Announcements 77(11):#PB-264 732/9GA. 1977]

C-1728-77
CHEMICAL ANALYSIS GIVES A "FINGERPRINT" FOR THE IDENTIFICATION OF OIL SPILLS [English summary]
Boeler, J. B., R. Lichtenthaler, and P. E. Paus. 1976.
Kjemi 36(10):19-21.

Source identification, Oil spills, Analytical techniques

Systems based on combinations of different analytical techniques which are useful in oil spill fingerprinting are described.

[from Chemical Abstracts 86(26):#194521q. 1977]

C-1729-77
STATUS OF GROUNDWATER CONTAMINATION IN THE UNITED STATES
Geraghty, J. J., and D. W. Miller. 1977.
Water Technology and Research Conference, 96th, New Orleans, 1976. Vol. 2. p.33-1-51-1.

Source identification, Contamination, Groundwater, Oil wells, Production, Wastewaters, *Brine disposal

The mechanisms and major sources of groundwater contamination, and federal legislation for protecting underground waters are reviewed. Industrial wastewater impoundments, land disposal of solid wastes, sludges, and wastewaters, and disposal of brines from oil wells and petroleum processing facilities are among the major contaminant sources.

[from Environment Abstracts 7(5/6):#77-03472. 1977]

C-1730-77
A CHARACTERIZATION OF THE SOURCES OF PETROLEUM HYDROCARBONS IN LAKE WASHINGTON
Wakeham, S. G. 1977.
Journal Water Pollution Control Federation 49(7):1680-1687.

Source identification, Hydrocarbons, Sediments, Lakes

Surface sediments of the title lake have higher concentrations of hydrocarbons (up to 1500 μg/g) than deeper sediments (approximately 30 μg/g); the sources of this contamination were surveyed. Results indicated sources include urban stormwater and freeway bridge runoff, rivers and creeks, rainfall, and dustfall. Although urban and bridge runoff contained the highest concentrations of petroleum hydrocarbons, a budget calculation showed that the rivers (and creeks) contributed nearly equal amounts of hydrocarbons to the lake as did the runoff.

C-1731-77

SOURCE OF OIL DISCHARGED INTO WATER

Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p. 9-26.

Source identification, Oil discharges, Natural seepage, Oil spills, Offshore development, Tankers, International agreements

A brief review is presented of the quantities and sources of oil in the marine environment including natural seeps, offshore exploration and production, spills from offshore wells, tanker accidents, operational discharges from ships and tankers, and oil from atmospheric sources. International oil pollution control agreements and industry agreements are briefly mentioned.

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

C-1732-77
EUROPA - NEW OIL BOOM UNIT (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(7):148.

Booms, Spill containment, Harbors, Inland, *Product information

The EUROPA - Emergency Unit for the Recovery of Oil in Pollution Accidents - is a new unit for dealing with oil on inland waterways and in harbors, made by Hoyle Marine Ltd., Merseyside. The unit can be towed to inaccessible locations (weighing less than 1150 kg) and has boom equipment that can be launched within four minutes to an 80 m extension.

C-1733-77
FLOATING OIL FENCE DESIGNED FOR RAPID DEPLOYMENT (product information)
Anon. 1976.
Ocean Industry 11(8):32.

Spill containment, Booms, Design-engineering, *Oilfence

The Oilfence, a portable floating spill containment barrier manufactured by Oil Spill Control Systems of Oakland, California, is described. The barrier is made of portable, connectible polyurethane sections especially designed for ease of handling in transport and deployment. The flexibility of the system facilitates configurations of the barrier to fit the specific oil containment situation.

[from Oceanic Abstracts 14(3):#77-02652. 1977]

C-1734-77
LARGEST BUBBLE BARRIER (product information)
Anon. 1977.
Ship & Boat International 30(5):31.

Spill containment, Tankers, Ports, Sweden, *Spill Bubble barrier

Atlas Copco has designed and installed at Gävle, Sweden, an oil protection bubble barrier to prevent the spread of an oil spill. A series of interconnected polyurethane air hoses stretch 475 m in a sectorized loop around the berthed tanker. Through numerous holes in the hoses, compressed air, fed from onshore compressors, rises to the surface to create a barrier curtain.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10597. 1977]

C-1735-77

OIL SPILLS PROMPT BOOM DESIGNS (product information)

Anon. 1977.
National Fisherman 58(3):10B.

Booms, Spill containment, Design-engineering, *Product information

Nils Lucander has an un-patented design for what he calls the "Lucan" Bottom Tension Oil Spill Control Boom, claimed to have been invented by a large oil company. According to Lucander, the USCG and the old Water Pollution Control Administration saw his model years ago "and state unequivocally it was the best they had seen and that it should be developed further." For information, contact Lucander at Box 3184, Brownsville, Texas, 78520.

C-1736-77

CONNECTOR HINGE FOR OIL CONTAINMENT BOOMS

Campbell, F. J., and D. J. Graham. 1977.
U.S. Patent 4,016,726

Spill containment, Booms, Design and engineering, Patent, *Connector hinge

A connector hinge is described for attaching oil spill containment booms having a male cylindrical connector which fits loosely within a female cylindrical connector to allow easy movement of both parts in both a vertical and horizontal direction. The connectors can be attached to a floating oil spill containment boom, an immovable object such as a pier or jetty, or a floating tow assembly.

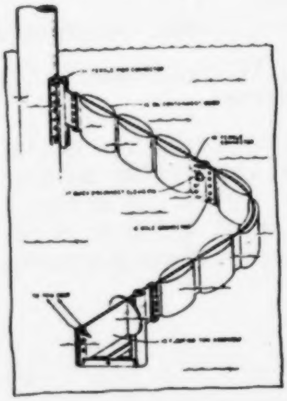
[from Petroleum Abstracts 17(34):#237,302. 1977]

4,016,726

CONNECTOR HINGE FOR OIL CONTAINMENT BOOMS

Francis J. Campbell, Stanford, and Douglas J. Graham, San Francisco, both of Calif., assignors to The United States of America as represented by the Secretary of the Navy, Washington, D.C.

Filed Aug. 21, 1975, Ser. No. 606,696
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 61—1 F **16 Claims**



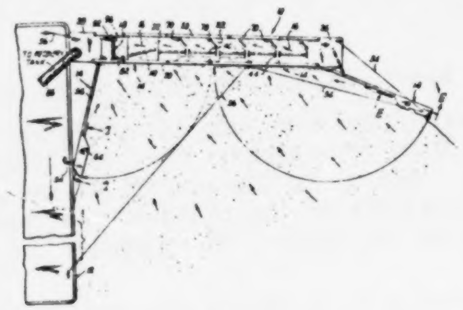
C-1737-77
OIL BOOM FOR COLLECTING AND SKIMMING OIL ON A WATER SURFACE
in'tVeld, C. 1977.
U.S. Patent 4,014,795

Spill containment, Booms, Skimmers, Design-engineering, Patent

Two parallel rows of floating barrier screen panels are supported by a framework which is connected to end floats. Flow diverter vanes beneath the barrier screen panels cause a surface transport current to flow between the 2 rows of the panels toward a surface skimmer located adjacent to one end of the boom.

[from Petroleum Abstracts 17(33):#237,017. 1977]

4,014,795
OIL BOOM FOR COLLECTING AND SKIMMING OIL ON A WATER SURFACE
Cornelis in'tVeld, Vlaardingen, Netherlands, assignor to National Marine Service, Inc., St. Louis, Mo.
Filed Nov. 24, 1975, Ser. No. 634,505
Int. Cl.² E02B *15/04*
U.S. Cl. 210—242 R **11 Claims**



C-1738-77
OIL SLICK INSTABILITY AND THE ENTRAINMENT FAILURE OF OIL CONTAINMENT BOOMS
Leibovich, S. 1976.
Journal of Fluids Engineering 98(3):98-105.

Spill containment, Booms, Behavior, Oil slicks, *Slick droplet formation, *Entrainment failure

Experimental evidence is shown to be consistent with the view that the onset of droplet formation in contained oil slicks is due to the breaking of finite interfacial waves; these waves result from the equilibration of amplifying Kelvin-Helmholtz waves. Conditions for droplet shedding from the headwave and from the entire slick are derived from this model.

C-1739-77

THE USE OF BOOMS

Newman, D. E. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith, (ed.). London, Graham & Trotman Ltd., 1976.
p.83-114.

Spill containment, Booms, Design and engineering, Freshwater, Oceans

The use of booms in oil spill containment is summarized with reference to different types of booms, including chemical oil herders and their functions, operations, design, and limitations. Four different spill situations and the effective use of booms are described. The situations cover oil spilled into a stream, oil entering an estuary from the sea, protection of freshwater intakes, and use of booms for corraling or collecting oil in open waters.

C-1740-77

FENDING DEVICE FOR OIL CONTAINMENT BOOM

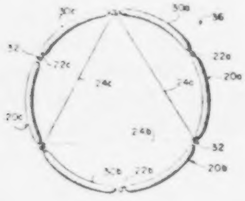
Nielsen, E. C. 1977.
U.S. Patent 4,000,532

Spill containment, Booms, Design and engineering, Patent

"The device for floating barriers has an open planar structure with associated buoyancy arrangements to give flotation on water substantially coplanar to the surface of the water. Fenders extend transversely of the plane of the structure and exceed above and below the water line to engage the barrier and block passage thereby."

[from Underwater Information Bulletin 9(4):39,#77/08/01. 1977]

4,000,532
FENDING DEVICE FOR OIL CONTAINMENT BOOM
Erik C. Nielsen, R.D. 3 Box 360-K, Toms River, N.J. 08753
Filed Mar. 5, 1975, Ser. No. 555,366
Int. Cl.² B63B *35/00*, E02B *15/04*
U.S. Cl. 9–8 R **10 Claims**



C-1741-77
SEABOOM TM, A PERMANENT OIL CONTAINMENT BARRIER
Tedeschi, E. T. 1976.
American Chemical Society. Division of Environmental Chemistry.
Preprints of Papers 16(2):123-126.

Spill containment, Booms, Design and engineering, *Seaboom

The Seaboom line of containment barriers consists basically of a sheet of rubber held vertically in the water by continuous flotation chambers containing closed-cell foam and stiffened by vertical ribs. The material does not foul and cannot snag on protruding structures. The booms have been in operation for over 5 years with no degradation in performance and little maintenance required.

[from Pollution Abstracts 8(4):#77-03387. 1977]

2. CLEANUP AND RECOVERY

C-1742-77
DRACONE 'BARGE' (product information)
Anon. 1977.
Ship & Boat International 30(5):33.

Spill recovery, Oil transport, Design and engineering, *Dracone barge

The Dunlop GRG Divison, Skelmersdale, UK, manufactures a 4,500 L capacity Dracone Barge. The 7.3 m (28 ft.) long barge is a towed, flexible unit made from synthetic rubber coated nylon fabric and cord, and is used for collecting and transporting salvaged oil at sea.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10471. 1977]

C-1743-77
FOAM CHIPS FOR OIL RECOVERY (product information)
Anon. 1977.
Ship & Boat International 30(5):33.

Spill recovery, Absorption, Design and engineering, USN, *Foam chips

Ocean Design Engineering Corporation (ODEC), California, has a patented oil-spill recovery system for the open ocean. The system recycles large quantities of urethane foam chips which absorb the oil, and is capable of recovering up to 132,475 L/hr (35,000 US gph) in continuous operation. A prototype has been built for the U.S. Navy.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10470. 1977]

C-1744-77
NEW SYSTEM CLEARS BIG OIL SPILLS (product information)
Anon. 1977.
Offshore Services 10(4):91.

Spill recovery, Blowouts, Booms, North Sea, Norway

Large scale blowouts off the coast of Norway should soon be able to be handled in difficult weather without chemicals. Statoil, negotiating on behalf of the North Sea Operators' Committee, has ordered two complete oil recovery systems and 1000 m of seagoing booms. Descriptions of the equipment, ordered from Thune-Eureka A/S and A/S Nofi, are given.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10594. 1977]

C-1745-77
NEW TANK CLEANING STATION NEEDED AT GOTHENBURG
Anon. 1977.
Holland Shipbuilding 25(12):71.

Oil tanks, Cleanup, Sweden, *Tank cleaning station

The separation technique used on board "Renare Har", a floating tank cleaning station, has been very effective in meeting the oil content limits for discharged waters imposed by the Swedish authorities. Götaverken is offering to carry out conversions of old tankers into similar cleaning stations.

[from Aquatic Sciences & Fisheries Abstracts 7(6):#7Q7585. 1977]

C-1746-77
OIL DISPERSANT SPARES SEA LIFE (product information)
Anon. 1977.
Ship & Boat International 30(5):33.

Spill cleanup, Dispersants, Emulsifiers, Solution, Toxicity

The Gamlen Chemical Co. Ltd., of Uxbridge, UK, has developed an emulsifier without a solvent, named Hydrogamosol LT. It has been approved by the British Warren Springs lab for its effectiveness and low toxicity, and meets the French standards of legislation for bio-degradable detergent products. The agent can be used in solution in sea water at concentrations of 2-4%, and will not deteriorate metal, concrete, rubber, wood, or plastic. When sprayed on the oil spill, a fine emulsion forms which can be dispersed by mechanical means.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10468. 1977]

C-1747-77
OIL RECLAIMER (product information)
Anon. 1977.
Water & Pollution Control 115(4):30.

Spill recovery, Reclamation, Design and engineering

The Olsen reclaimer, a floating, self propelled unit for cleaning up harbor spills and oil slicks, is described. The device collects oil at a rate up to about 570 L/min (150 gpm) depending on the thickness of the oil layer, and it delivers a product that is readily processed for oil reclamation. The unit is available from MSC Engineering Systems Ltd., 265 Canarctic Drive, Downsview, Ontario M3J 2N7, Canada.

C-1748-77
OIL SKIMMER RECOVERS 1-50 GPM (product information)
Anon. 1977.
The Oil and Gas Journal 75(32):93.

Skimmers, Spill recovery, Design and engineering

A floating, weir-type oil skimmer, the Slurp, has no moving parts or necessary adjustments. The producing company, Seaward International Inc., also advertises a self-contained emergency oil-spill response system. Write to Seaward International at 6269 Leesburg Pike, Falls Church, VA.

C-1749-77
OIL SPILL PUMP (product information)
Anon. 1977.
Offshore 37(6):76.

Pollution control, Spill cleanup, *Oil spill pumps

The Frank Mohn Company has developed an oil salvage pump system for use against uncontrolled blowouts or other types of oil spills. The pumps can take up spills at the same rate as oil gushing from the well.

C-1750-77
OIL SPILLS
Anon. 1976.
Ocean Industry 11(10):75-79.

Spill recovery, Absorption, Skimmers, Booms, Ships

Recent developments in oil spill recovery technology are examined including the use of absorbent polyurethane foam chips, absorbent ferromagnetic polyfoam, and several specially designed oil spill recovery vessels, booms, and skimmers.

[from Oceanic Abstracts 14(3):#77-02661. 1977]

C-1751-77
OIL SPILLS IN BAD WEATHER: SKUTENG A/S AND A/S BLEHR & TENVIG HAVE THE SOLUTION
Anon. 1977.
Scandinavian Oil Gas Magazine 5(4):27-29.

Spill recovery, Design and engineering, North Sea, *Oil collection systems

The article reports the progress of the title companies toward reaching a solution to the collection of offshore oil spills. Skuteng feel they have developed an ideal system to collect oil during bad weather. Blehr & Tenvig have patented a stabilizer system which can reduce the heaving motion of a ship at sea. Both companies think that the systems could be effectively coordinated for use in the North Sea.

[from Petroleum Abstracts 17(34):#237,304. 1977]

C-1752-77
POLLUTION CONTROL - PUMP SETS FOR OIL SLICK DISPERSAL
Anon. 1977.
Marine Engineers Review 7(February):34.

Dispersants, Booms, Oil slicks, Spill cleanup, *Pumps

Megator Pumps and Compressors Ltd., London, have introduced a 2 pump package for feeding concentrated oil dispersant and seawater to spray vessels' booms. The sets have been approved for use with the Warren Spring Laboratory spray boom system which is designed to apply dispersant to floating oil and then, by means of specially designed breaker boards, to agitate the surface of the treated oil to speed dispersion of the slick.

C-1753-77
PUMPS FOR OIL-SPILL CLEARANCE (product information)
Anon. 1977.
Ship & Boat International 30(5):33.

Spill cleanup, Design-engineering, *Oil-spill pump

The self-priming flameproof Wilden pump can pass most solids of up to 5.08 cm (2 in) in size and, if damaged, can be repaired on site. Thus, the dangers of electrical shock or flame hazards from an electric pump are eliminated. The pumping capacities range from a few liters (gallons) up to 757 L/min (200 gpm).

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10469. 1977]

C-1754-77
RCMP LINK WITH NEELS AIDS OIL SPILL CLEAN UP (news brief)
Anon. 1977.
Water & Pollution Control 115(4):13.

Spill cleanup, Spill containment, Canada, *Equipment locator system

The Royal Canadian Mounted Police (RCMP) has been linked with Canada's computer-based National Emergency Equipment Locator System (NEELS) in order to aid the country in quickly locating spill containment and cleanup equipment when a spill occurs.

C-1755-77
SKIMJET REMOVES OIL FROM SURFACE OF WATER (news brief)
Anon. 1977.
Water & Pollution Control 115(4):68.

Spill recovery, Skimmers, Design and engineering, *Skimjet

Skimovex B.V. has developed a unit, the Skimjet, which can remove 98% of oil from a 500 m^2, 2 cm thick oil spill per hour, regardless of the viscosity of the oil. The system uses jets of water to direct and push the oil into a floating, bottomless enclosure. Advantages of the system include simplicity of operation, high capacity, and insensitivity to wind and waves up to 0.7 m. The collected oil contains virtually no water. The unit is adaptable for land based and marine applications.

C-1756-77
SYSTEM RECOVERS OIL AT 250 BBL/HR RATE (product information)
Anon. 1977.
The Oil and Gas Journal 75(32):90.

Skimmers, Spill recovery, Design and engineering

The new ZRV Dynamic Skimmer recovers oil by moving an adsorbent floating rope mop in the opposite direction of vessel travel at up to six knots. For more information, write to Oil Mop Inc., Drawer P, Belle Chase, LA. 70037.

C-1757-77
SYSTEM RECOVERS SPILLS FAST (product information)
Anon. 1977.
The Oil and Gas Journal 75(34):141.

Contingency planning, Spill recovery, *Response teams, U.S.

A new system of two crews of six-man teams is on standby twenty-four hours a day for 5-hr on-scene response to over fourteen western states. The system covers oil and other spills at train, truck, boat, or barge accidents. For further informatiom write to Western Environmental Services Div., Willamette-Western Corp., Foot of North Portsmouth Ave., Portland, OR 97203.

C-1758-77
WIDE RANGE OF OIL POLLUTION GEAR FROM U.S. MAKER (product information)
Anon. 1977.
Ship & Boat International 30(5):32.

Spill recovery, Skimmers, Design-engineering, *Seaward International

Seaward International of Falls Church, Virginia, offers SLURP (Self-Levelling Unit for Removing Pollution), the Spiltrol harbour skimmer, and the Huskey offshore skimmer, as well as other pollution control equipment. The skimmers operate in a variety of water conditions and are self-propelled and non-self-propelled.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10467. 1977]

C-1759-77
EVALUATION OF ACTIVATED CARBON FOR FUEL OIL ADSORPTION FROM A POTABLE WATER SUPPLY
Allen, D. H. 1976.
Final report, AFCEC-TR-76-46. 12p.

Fuel oil, Contamination, Fresh water, Adsorption, *Activated carbon, *Water supply

The use of activated carbon adsorption for removing diesel fuel from a contaminated Air Force water supply was found to be a highly effective and extremely rapid process.

[from Government Reports Announcements 77(12):#AD-A037 478/5GA. 1977]

C-1760-77
STUDY OF THE CREATION OF PROTECTIVE AND SORBENT MATERIALS FOR OIL SPILLS [in Russian]
Anufrieva, N. M. 1975.
Kompleksnye Issledovaniya Microvom Okeane. M. E. Vinogradov (ed.). Moscow, USSR, Akademia Nauk SSSR, 1975. p.331-335.

Spill cleanup, Spill containment, Absorption, *Polyurethane foams

"Polyurethane foams prepared by foaming easily transportable polyurethane components directly in contact with petroleum on water surfaces, entrap petroleum leaving only a thin film."

[from Chemical Abstracts 87(2):#82718. 1977]

C-1761-77
A FAST-CURRENT OIL RECOVERY DEVICE
Ayers, R. R., and J. M. Ward. 1977.
Ecolibrium 6(3):12-14.

Spill recovery, Skimmers, Design-engineering, *Fast current oil recovery

Currently available oil spill recovery equipment is generally limited to operating in water current speeds of under 4 km/hr (2 knots). The newly developed zero-relative-velocity (ZRV) oil skimmer is described, and its performance in a series of developmental USCG tests is summarized. The ZRV skimming concept has been shown by tests to be capable of recovering oil effectively in 7-18 km/hr (4-10 knot) currents.

C-1762-77
INSTALLATION TO COLLECT A LIGHT MATERIAL FLOATING ON A WATER SURFACE
(Ballast Nedam Groep NV). 1975.
Netherlands Application 7,510,151

Spill recovery, Design-engineering, Patent

The installation is submerged in water and consists of a wall around a collection space. Collection mechanisms move the light material to the collection space. The wall consists of a multitude of panels which can be moved into positions to provide water-tight connections between intermediate flexible wall panels.

[from Petroleum Abstracts 17(35):#237,684. 1977]

C-1763-77
A PROCESS FOR ABSORBING OIL FROM WATER
Barnes, R. I. 1977.
British Patent 1,472,964

Absorption, Contaminants, Patent, *Oil-absorbent compound

An oil-absorbent compound consisting of the reaction product of a carbohydrate and a metal oxide is added to the water. The carbohydrate may be a disaccharide, monosaccharide, or polysaccharide; the metal oxide is the oxide of a metal in Group II of the Periodic Table of Elements.

[from Petroleum Abstracts 17(30):#235,883. 1977]

C-1764-77
SPILLAGE INTO WATER - TREATMENT
Canevari, G. P. 1976.
Encyclopedia of Environmental Science and Engineering. J. R. Pfafflin, and E. N. Ziegler (eds.). New York, Edward N. Gordon & Breach, 1976. Vol. 2. p.793-809.

Spill cleanup, Spill containment, *Treatment methods

Various methods in which oil spills can be handled are discussed and the merits of the different methods are compared.

[from Chemical Abstracts 87(2):#8219v. 1977]

C-1765-77

SEPARATING OIL FROM OIL-CONTAMINATED SURFACES

Chambers, D. B., B. Walker, E. Chadwick, and J. N. Greenshields.
1977.
German Offenlegungsschriften (unexamined patent application)
2,639,149

Contamination, Oil tanks, Absorption, Patent, *Cleanup

The preparation of a cleaning composition used for the spray cleaning of oils from surfaces of storage tanks, etc., is described.

[from Chemical Abstracts 86(24):#173451b. 1977]

C-1766-77

SOLIDIFICATION OF LEAKED OILS AND OIL LEAKING PREVENTION

Chikami, K. 1976.
Japanese Kokai (unexamined patent application) 76 87,349

Tankers, Leakage, Spill cleanup, Patent, *Oil solidification

A mixture which includes urethane and trichloroethane is added to oils leaked or leaking from oil tankers. This causes rapid solidification and stops the leak.

[from Chemical Abstracts 87(4):#28641e. 1977]

C-1767-77

OIL RECOVERY PERFORMANCE OF THE LOCKHEED DISC-DRUM DEVICE - A PARAMETRIC STUDY

Chung, J. S., and C. E. Rudiger, Jr. 1976.
Oceans '76 Conference, Washington D. C., 1976. p.12B-22B.

Spill recovery, Design-engineering, Lockheed disc-drum device, *Performance

Using test data obtained on Lockheed disc-drum oil recovery devices, parameters affecting their performance were investigated. Very high recovery rates were obtained over a wide range of oil properties and oil layer thicknesses including thin slicks. Optimal recovery rates were obtained for oils with a viscosity between 200-1500 centistokes.

[from Environment Abstracts 7(5/6):#77-03169. 1977]

C-1768-77
OIL AND LUBRICANTS IN WATER. HOW CAN MAN REMOVE IT?
Enke, C. G. 1976.
Wasser, Luft und Betrieb 20(12):685-688.

Emulsions, Filtration, Evaporation, Incineration, *Oil removal

Emulsion breaking, ultrafiltration, evaporation, and incineration are emphasized in this review with no references.

[from Chemical Abstracts 87(6):#43551u. 1977]

C-1769-77
SELECTION CRITERIA AND LABORATORY EVALUATION OF OIL SPILL SORBENTS
Environmental Protection Service. 1976.
No. EPS-4-EC-76-5. 53p.

Spill recovery, Absorption, Cost analysis, *Sorbents, *Performance evaluation

Twenty different types of oil spill sorbents were studied in terms of desirable performance and operational criteria. Oil pick-up capacities were determined and then correlated with sorbent prices to give oil sorption costs. Of the materials examined, the synthetic polymeric sorbents exhibited the highest oil pick-up capacities and oil/water ratios.

[from Petroleum Abstracts 17(32):#236,712. 1977]

C-1770-77
SINKING AND DISPERSING OIL
Farn, R. J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters. J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976. p.159-180.

Spill cleanup, Dispersants, Toxicity, Sinking agents

The sinking of oil as a means of spill cleanup is not considered a successful method because of the potential damage to benthic life and fisheries resources in many areas. The use of oil spill dispersants is presently the most effective and widely used method of combatting oil pollution in the open sea, coastal waters, and shorelines. The development and evaluation of the performance and toxicity of various dispersants by laboratory tests and sea trials are described. The methods of dispersant application in various spill situations are reviewed.

C-1771-77
PETROLEUM WASTES IN THE SOIL
Harris, J. O. 1976.
Land Application of Waste Materials. Ankeny, Iowa, Soil Conservation Society of America, 1976. p.249-253.

Spill cleanup, Petroleum products, Soil, Sources, Biodegradation, Oxidation, Absorption

Petroleum products likely to pollute land are extremely variable in composition and physical characteristics; and spills may result from pipeline breaks and accidents or leakage during transport or storage. The roles of oxidation and biodegradation of oil by soil microorganisms are reviewed, and methods for onland spill containment, cleanup and recovery are summarized. Cleanup is best achieved by adsorption on straw, hay, ground corn cobs, and various sponge-like plastic absorbents.

[from Pollution Abstracts 8(4):#77-03948. 1977]

C-1772-77
APPARATUS FOR SEPARATING DISPERSIONS OF TWO IMMISCIBLE LIQUIDS [in German]
Hartman, R., and O. Kuz. 1976.
German Patent 2,164,476

Dispersions, Oil-water separation, Spill cleanup, Design and engineering, Patent

"This apparatus for separating dispersions consists of a tank with horizontal baffle plates of corrugated or zigzag sheet metal and a distributor consisting of a fill separated from the baffles by a perforated plate. The space between the baffle plates is filled with a material preferentially wetted by the dispersed phase."

[from Petroleum Abstracts 17(23):#234,065. 1977]

C-1773-77
OIL COLLECTION
Hoketsu, H. 1977.
Japanese Kokai (unexamined patent application) 77 12,687

Spill cleanup, Dispersants, Patent, *Magnetic powder

"Oil on water is dispersed with irregular granules of plastics mixed with powdered magnetic metal and collected magnetically as oil balls."

[from Chemical Abstracts 87(8):#58182y. 1977]

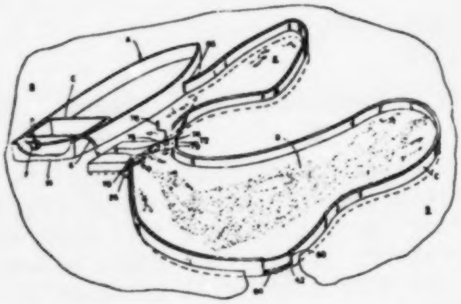
C-1774-77
PROCESS FOR EMERGENCY SMALL SPILL CONTROL
Irons, D. E. 1977.
U.S. Patent 4,006,082

Spill recovery, Booms, Patent

Floating oil or other contaminants are recovered by a process that involves use of a floating sump and a flexible floating boom. The boom is attached to the sump and is placed in the water so as to encircle the sump and at least part of the spill. Take-up arrangements originating at the sump are used to gradually decrease the area of the spill, and the floating pollutant is pumped into a storage vessel.

[from Underwater Information Bulletin 9(4):42, #77/08/38. 1977]

4,006,082
PROCESS FOR EMERGENCY SMALL SPILL CONTROL
Denis E. Irons, San Francisco, Calif., assignor to Murphy Pacific Marine Salvage Co., Emeryville, Calif.
Filed May 12, 1975, Ser. No. 576,944
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—83 **1 Claim**



C-1775-77
MECHANICAL DEVICES
Jeffrey, P. G. 1976.
The Control of Oil Pollution on the Sea and Inland Waters. J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976. p.115-140.

Spill recovery, Skimmers, Design and engineering

Five basic types of oil skimmers are described and evaluated based on their underlying principles of operation and deployment. Included are skimmer types that rely on: 1) adhesion of oil to a solid surface such as a metal disk; 2) adhesion to a continuous flexible belt drawn along the the oil/water interface; 3) centrifugal devices that create a vortex for increasing oil layer thickness; 4) devices with one or more weirs; and 5) more than one method of operation.

C-1776-77
OIL-ABSORBING MATERIAL
Kumitomo, Y., H. Ono, T. Saida, K. Nakarai, and T. Wagatsuma.
1977.
German Offenlegungsschriften (unexamined patent application)
2,621,961

Spill recovery, Absorption, Incineration, Patent, *Absorbent fibers

Peat fibers are mixed with melted polyolefin to form a material that absorbs floating oil and can be burned after use.

[from Chemical Abstracts 87(2):#7052y. 1977]

C-1777-77
REMOVAL OF SPILLED OIL FROM WATER
Murata, K. 1976.
Japanese Kokai (unexamined patent application) 76,110,479

Spill recovery, Fuel oil, Adsorption, Patent, *Sawdust

A chip or powdered oil adsorbent is spread over an oil spill and then solidified by spraying with an alkali metal silicate and a hardening agent. Experiments used sawdust to remove fuel oil from water.

[from Chemical Abstracts 87(4):#28832t. 1977]

C-1778-77
STUDY OF POLYURETHANE FOAM AS A MEDIUM TO REMOVE PETROLEUM FROM THE SURFACE OF OCEANS [in Russian]
Nemirovskaya, I. A., N. M. Anufrieva, and A. B. Gornitskii. 1975.
Kompleksnye Issledovaniya Mirovom Okeane. M. E. Vinogradov (ed.).
Moscow, USSR, Akademia Nauk SSSR, 1975. p.327-330.

Spill cleanup, Absorption, Oceans, *Polyurethane foams

"Polyether-based polyurethane foams are unsuitable for absorbing spills, but polyester-based ones absorb 18.6 times their own weight of petroleum, 94.2% of which can later be extracted with petroleum ether containing a small amount of $CHCl_3$."

[from Chemcial Abstracts 87(2):#8270e. 1977]

C-1779-77
IMPROVEMENTS IN OIL SLICK DISPERSANT APPARATUS
Noel, R. A. 1976.
South African Patent 75/7,078

Oil slicks, Dispersants, Spill cleanup, Design-engineering, Patent

"The apparatus consists of an eductor, a source of concentrated dispersant connected to an inlet of the eductor, and a pump adapted to pump water through the eductor to at least one suitable nozzle. The water is mixed with concentrate in the eductor."

[from Petroleum Abstracts 17(23):#234,064. 1977]

C-1780-77
RECOVERY OF SPILLED OIL ON SEA WATER OR RIVER WATER
Okhori, K. 1976.
Japanese Kokai (unexamined patent application) 76 87,507

Spill recovery, Seawater, Rivers, Solvents, Flocculation, Coagulation, Patent

Spilled oil is sprayed with an aromatic solvent containing a flocculant, and then with a coolant, such as dry ice, to coagulate the oil and to form an oil fence.

[from Chemical Abstracts 87(4):#28640d. 1977]

C-1781-77
REMOVAL OF PETROLEUM FROM THE SURFACE OF WATER
Pelevin, L. A., G. N. Pozdnyshev, Yu. Kh. Lukmanov, et al. 1977.
USSR Patent 548,573

Spill recovery, Absorption, Surfactants, *Sorbent-wood chips

"Petroleum was removed from the surface of water by treating the water with a sorbent, e.g. wood chips, and then with a 0.1-10.0% solution of a surfactant based on Oxyphos."

[from Chemical Abstracts 87(2):#11414k. 1977]

C-1782-77
ABSORBENT PRODUCTS FOR HYDROCARBONS
Porte, P. 1976.
U.S. Patent 3,990,970

Oil slicks, Spill recovery, Absorption, Patent

A pulp of an artificial or synthetic polymer, preferably a polyamide or polyester, is used as an absorbent for petroleum products spread on the surface of water. The pulp can be coated with 1 to 5% of its weight of a hydrophobic and oleophilic material especially a long chain paraffin or chlorinated paraffin.

[from Selected Water Resources Abstracts 10(13):#W77-06456. 1977]

C-1783-77
IMPROVEMENTS IN OR RELATING TO REMOVING OIL FROM BEACHES AND THE LIKE
Rogers, J. 1977.
British Patent 1,478,008

Spill recovery, Beaches, Dispersants, Surfactants, Patent

A stream of water is mixed with a dispersant composition consisting of a solution or suspension in an organic solvent of one or more surfactants (at least one of which is a gelling agent). The mixture is applied to the surface and subsequently permits rinsing of the surface to remove the mixture and contamination.

[from Petroleum Abstracts 17(33):#237,023. 1977]

C-1784-77
FLOTATION PURIFICATION OF SEAWATER BY REMOVING EMULSIFIED PETROLEUM PRODUCTS [in Russian]
Skrylev, L. D., V. K. Ososkov. 1977.
Khimicheskaya Tekhnologiya (Kiev) No. 1:50-51.

Oil-water separation, Emulsions, Seawater, Petroleum products, Flotation

A model emulsion of seawater contained 18 g/L mineral salts and 300-400 mg/L engine oil or diesel fuel dispersed in the form of particles with diameters of 7μ. This emulsion was subject either to pressure flotation at 5 atm or saturated with air dispersed by passage through porous material. The second method was more effective.

[from Chemical Abstracts 86(24):#176692s. 1977]

C-1785-77
PROCESS AND APPARATUS FOR RECOVERY OF A SHEET OF LIQUID FLOATING ON WATER
(Soc. Gen. Cons. Elec. Mec. Alst.). 1977.
Belgian Patent 822,629

Oil slicks, Spill recovery, Design and engineering, Patent

This process consists of passing both water and pollutant through a cyclone separation by means of a suction pump placed at the lower outlet of the polluted water.

[from Petroleum Abstracts 17(27):#235,295. 1977]

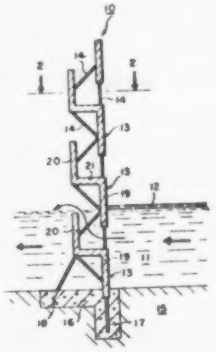
C-1786-77
SKIMMER FENCE
Stovall, L. F. 1977.
U.S. Patent 4,000,618

Spill recovery, Skimmers, Booms, Design-engineering, Patent

An apparatus for removing floating oil from flowing water is described. The device consists of a vertically-deployed, fence-like boom provided with a series of connected, vertical and horizontal baffles that form a number of flow passageways for the entrainment of oil.

[from Underwater Information Bulletin 9(4):39,#77/08/04. 1977]

4,000,618
SKIMMER FENCE
Leland F. Stovall, Corpus Christi, Tex., assignor to Exxon Production Research Company, Houston, Tex.
Filed Apr. 28, 1975, Ser. No. 572,556
Int. Cl.^{2} E02B *3/00*
U.S. Cl. 61—1 F **3 Claims**



C-1787-77
OIL ADSORBENT USEFUL FOR TREATMENT OF SPILLED OIL

Takahashi, R., T. Sone, and T. Hirata. 1977.
Japanese Kokai (unexamined patent application) 77 19,190

Spill cleanup, Adsorption, Gasoline, Fuel oil, Patent

An oil adsorbent is made by mixing a block copolymer with oil, olefin monomer, copolymer, or filler, and then foaming. The resulting foam has oil-adsorbing capacities of 0.30, 0.35, and 0.41 g/cm^3 for gasoline, kerosene, and fuel oil, respectively.

[from Chemical Abstracts 87(6):#43818m. 1977]

C-1788-77
APPARATUS FOR REMOVAL OF OIL FILMS FROM WATER

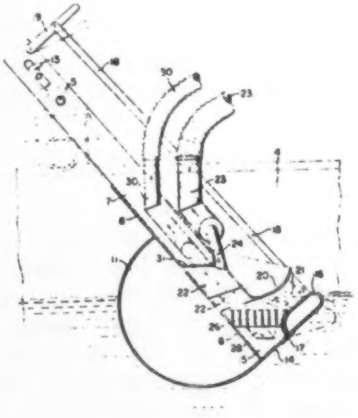
Tsunoi, I. 1977.
U.S. Patent 4,006,086

Oil slicks, Spill recovery, Skimmers, Ships, Design-engineering, Patent

The apparatus comprises a floating elongate chamber which is pivotably supported between the hulls of a catamaran-type ship. The forward end of the chamber has an inlet opening behind which an adjustable weir and an inclined, horizontal plate serve to capture the oil film. Two separate pump and conduit arrangements remove water and oil respectively from the chamber.

[from Underwater Information Bulletin 9(4):42,#77/08/39. 1977]

4,006,086
APPARATUS FOR REMOVAL OF OIL FILMS FROM WATER
Ikuo Tsunoi, Yokohama, Japan, assignor to Kabushiki-Kaisha Kyoei Senpaku Kogyo, Yokohama, Japan
Filed May 14, 1975, Ser. No. 577,554
Claims priority, application Japan, July 1, 1974, 49-75217
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 R **2 Claims**



C-1789-77
A TOWED PLANING HULL SLED FOR FAST SURFACE DELIVERY OF POLLUTION CONTROL EQUIPMENT (product information)
Ward, R. S., and R. M. Larrabee. 1977.
Naval Engineers Journal 89(2):129-137.

Pollution control, USCG, *Equipment, *Fast Surface Delivery System

A Fast Surface Delivery System was developed for the USCG for use in pollution control at sea. The all-aluminum sled, towable by helicopter and surface vessel, can deliver a 9.1 metric ton (20,000 lb) payload and be unloaded manually at sea.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10451. 1977]

C-1790-77
ABSORBENTS, BURNING AND GELLING
Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p.141-159.

Spill cleanup, Absorption, Incineration, *Gelling agents

The cleanup of oil spills by using absorbent materials, combustion, and gelling agents that immobilize oil is described, and the efficacy of each method is assessed. Suitable absorbents include inorganic materials like vermiculite, natural organic material such as peat and straw, and synthetics including polyethylene foams and fibres. Combustion of oil spills is not satisfactory in most situations and does not represent a successful method. The gelling of oil products to facilitate handling or to prevent a spill from spreading has been tested and applied successfully but is too expensive for large-scale application.

C-1791-77
SEA AND FRESHWATER SPILLS
Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p.181-202.

Spill cleanup, Dispersants, Absorption, Disposal, Coasts, Marshes, Beaches, Seawater, Freshwater

The most suitable methods available for oil spill cleanup along the shore and on beaches include mechanical removal and the use of dispersants and absorbents. The methods for removing oil from swamps, mud flats, sandy and rocky beaches, large rocks, cliffs and manmade structures, and inland spills are briefly described. The disposal of oil contaminated beach material remains a difficult problem; disposal methods on land should be used which assure biodegradation.

3. RESTORATION

C-1792-77
CLEANING AGENTS FOR OILED WILDLIFE
Berkner, A. B., D. C. Smith, and A. S. Williams. 1977.
Ecolibrium 6(3):15-19.

Restoration, Wildlife, Oil spills, Surfactants, Solvents, Toxicity

The advantages and limitations of detergents and solvents in saving oiled wildlife are discussed with respect to the type of wildlife affected, the types of oil involved, and the treatment facilities and equipment available. Several commercial detergents are compared for their cleansing ability, optimal concentrations, and toxicity and/or side effects.

C-1793-77
CHANGES IN VEGETATION OF AN OILED SOUTHAMPTON WATER SALT MARSH
Dicks, B. 1977.
Recovery and Restoration of Damaged Ecosystems. J. Cairns, Jr., K. L. Dickson, and E. E. Herricks (eds.). Charlottesville, University Press of Virginia, 1977. p.208-240. Proceedings of the International Symposium on the Recovery of Damaged Ecosystems, Blacksburg, Virginia, March 23-25, 1975.

Restoration, Vegetation, Marshes, Contamination, Wastewaters, Refineries, England, *Salt marsh

Progressive damage was incurred in a salt marsh in Southampton Water, Hampshire, England, due to effluent that was discharged from a refinery between 1951 and 1970. An area 1000 m by 600 m had been denuded of vegetation. This appears to have been a result of repeated contamination of the marsh by oil films. The pattern of recolonization of damaged areas is discussed.

C-1794-77
RECOVERY OF SOME BRITISH ROCKY SEASHORES FROM OIL SPILLS AND CLEANUP OPERATIONS
Nelson-Smith, A. 1977.
Recovery and Restoration of Damaged Ecosystems. J. Cairns, Jr., K. L. Dickson, and E. E. Herricks (eds.). Charlottesville, University Press of Virginia, 1977. p.191-207. Proceedings of the International Symposium on the Recovery of Damaged Ecosystems, Blacksburg, Virginia, March 23-25, 1975.

Restoration, Shorelines, Oil spills, Biological effects, Mollusks, Algae, *Rocky shores, England

The effects of oil spills of varying severity are described. The most striking result is a reduction in the numbers of grazing mollusks, especially limpets, resulting in successive blooms of green and brown algae. Recovery periods varied from up to 7 years after a major crude-tanker wreck to virtually no time after a small spill of heavier oils. Chronic pollution by an oily refinery effluent has modified the balance of shore populations so that complete recovery can never occur.

4. OIL TRANSFER AND TRANSPORT

C-1795-77
TANKERS DISMISSED IN U.S. OIL STORAGE PLAN
Baron, V. C. 1977.
Seatrade 7(4):116.

Tankers, Storage, Crude oil, Environmental protection, FEA

The Petroleum Reserve Plan of the U.S. Federal Energy Administration indicates that FEA's program for long-term crude oil storage will not use tankers. FEA requires storage facilities that are feasible, environmentally acceptable, cost competitive, capable of storing large volumes, and near to pipeline and seaport distribution systems. There are a wide range of pollution prevention and maintenance considerations as well which would raise the costs of using tanker storage.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10842. 1977]

C-1796-77
OIL STORAGE TANK
Bell, A. O., and J. C. Feben. 1977.
British Patent 1,467,238

Storage, Tankers, Design and engineering, Patent, *Oil storage tank

A marine structure for storing oil and for providing a mooring for a tanker is described. The tank controls the flow rate of the oil and allows for discharging water from it. Buoyance is controlled through an air and water discharging system between the tank's inner and outer walls.

[from Petroleum Abstracts 17(23):#234,020. 1977]

C-1797-77
CRUDE OIL TRANSPORTATION SYSTEM: VALDEZ, ALASKA TO MIDLAND, TEXAS (AS PROPOSED BY SOHIO COMPANY) - CHAPTERS 1-9
Bureau of Land Management. 1976.
U.S. Bureau of Land Management Draft Environmental Impact Statement. 2233p.

Oil transport, Pipelines, Alaska, Texas, EIS, Crude oil, Oil spills

A pipeline east of the Rocky Mountains is proposed by Standard Oil Co. of Ohio to transport Alaskan crude oil, to relieve the prospective regional crude supply and demand imbalance, and to reduce dependence on foreign crude oil imports. Such a project would reduce the threat of oil spills into the ocean as it would reduce the transport of oil by sea.

[from Energy Information Abstracts 2(2):#77-21489. 1977]

C-1798-77
STRATEGIC PETROLEUM RESERVE.
Federal Energy Administration. 1976.
Final Environmental Impact Statement, FEA/S-76/487-Vol-1; FES-76/2-Vol-1. 583p.

Crude oil, Storage, Environmental effects, EIS, *Salt domes, Oil tanks, *Strategic Petroleum Reserve

Underground storage of crude oil in solution-mined salt domes and conventional mines, and above ground storage in tanks have been proposed as a strategic petroleum reserve. This final environmental impact statement identifies particularly sensitive environmental parameters that are investigated in greater detail in site-specific environmental impact statements.

[from Scientific and Technical Aerospace Reports 15(13):#N77-22675. 1977]

C-1799-77
STRATEGIC PETROLEUM RESERVE
Federal Energy Administration. 1976.
Final Environmental Impact Statement, FEA/S-76/488-Vol-2; FES-76/2-Vol-2. 273p.

Crude oil, Storage, Environmental effects, EIS, *Salt domes, *Mines, *Strategic Petroleum Reserve

"Comments on the programmatic environmental impact statement (Volume 1) from federal, state, and local agencies and private industry concerning storage of crude oil underground in solution-mined salt cavities and in conventional mines are presented."

[from Scientific and Technical Aerospace Reports 15(13):#N77-22676. 1977]

C-1800-77
STRATEGIC PETROLEUM RESERVE. BAYOU CHOCTAW SALT DOME
Federal Energy Administration. 1977.
Supplement to Final Environmental Impact Statement, FEA/S-77/129, FES 76-5. 175p.

Crude oil, Storage, Environmental effects, EIS, Louisiana, *Bayou Choctaw Salt Dome

This site-specific EIS Supplement analyzes the environmental impacts caused by site preparation and operation of the proposed St. James oil distribution system, and compares these impacts with those associated with the Addis distribution system considered in the final EIS.

[from Petroleum Abstracts 17(30):#235,912. 1977]

C-1801-77
HOW TO MAKE TANKERS SAFER
Mayer, A. J., et al. 1977.
Newsweek 89(3):60-61.

Oil transport, Tankers, Safety, *Standards, *Accident prevention

The record-breaking rash of accidents involving commercial tankers is likely to result in the imposition of tough new safety standards. Double hulls, segregated ballast, backup systems, and collision-avoidance radar should be standard equipment on all commercial oil tankers, especially supertankers which are considered to be immediately hazardous, difficult to control, and astonishingly fragile.

[from Environment Abstracts 7(5/6):#77-03156. 1977]

C-1802-77
TRANSPORT OF MINERAL OIL COMPONENTS TO GROUNDWATER. PT. 2. INFLUENCE OF LIME, CLAY AND ORGANIC SOIL COMPONENTS ON THE RATE OF TRANSPORT
van der Waarden, A., W. M. Groenewoud, and A.L.A.M. Bridie. 1977.
Water Research 11(4):359-365.

Oil transport, Groundwater, Adsorption, *Lime, *Clay, *Soil components

The adsorption of a model compound and of oil components on lime, clay, and organic soil components is discussed. It is demonstrated that adsorption may reduce the total amount of oil transport to groundwater, reduce concentrations, and delay transport.

[from Petroleum Abstracts 17(27):#235,271. 1977]

5. WASTE TREATMENT AND DISPOSAL METHODS

C-1803-77
EVAPORATION AND THERMAL OXIDATION OF LIQUID EFFLUENTS - BY BURNING WITH FLAME IN COMBUSTION CHAMBER
(Inventor unknown). 1976.
French Patent 2,302,483

Wastewater treatment, Refineries, Evaporation, Incineration, Patent, *Thermal oxidation

This process provides for the treatment of effluents containing toxic products from refineries and plants which chemically treat petroleum products. A continuous evaporation process is created and combustible substances are burned and eliminated by thermal oxidation. The effluent is vaporized by convection currents in the combustion chamber. Solid wastes can be burned along with the effluent products by mixing with the fuel.

[from Selected Water Resources Abstracts 10(15):#W77-07227. 1977]

C-1804-77
AN ECONOMIC CASE STUDY OF WASTE OIL AND ITS WIDER SIGNIFICANCE
Anon. 1977.
Solid Wastes 67(2):86-87.

Waste oil disposal, Storage, Economics, UK

About 65,000 tons of reasonably high quality waste oil are wasted each year in the United Kingdom alone. This study concludes that the costs of providing waste oil storage and collection centers are not likely to be small, but would reduce the illegal disposal of oil by motorists and industry.

[from Pollution Abstracts 8(4):#77-03514. 1977]

C-1805-77
FLOTATION MACHINE (product information)
Anon. 1977.
Water & Pollution Control 115(4):30.

Wastewater treatment, Oil-water separation, Emulsions, Flotation, Design and engineering

The Wemco Hydrocleaner flotation machine, which separates oil, solids, and organic matter from wastewater, is described. The system can clean wastewaters containing up to 50,000 ppm oil, depending on type of oil and emulsion, leaving an effluent with typically less than 10 ppm oil. The Wemco Hydrocleaner is available from Envirotech Canada, Ltd., 5155 Creek Bank Road, Mississauga, Ontario, Canada.

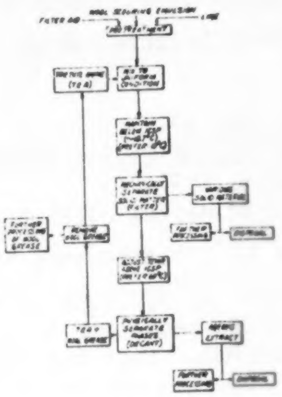
C-1806-77
OIL EMULSION PROCESSING
Ames, R. K., and H. H. Peters. 1977.
U.S. Patent 4,002,562

Oil-water separation, Emulsions, Patent, *Amine addition

A method for separating oil-water emulsions that contain solids is described. The emulsion is mixed with one or more amines in which the oily component is soluble and exhibits an inverse critical solution point in a 2-phase system with water such that the mixture forms a single, continuous liquid phase. Heating to just below the critical solution point removes the solids and amine(s); further heating separates the oil and water phase.

[from Chemical Abstracts 87(2):#8036h. 1977]

4,002,562
OIL EMULSION PROCESSING
Robert K. Ames, Seattle, and Hans H. Peters, Federal Way, both of Wash., assignors to Resources Conservation Co., Renton, Wash.
Filed Sept. 18, 1975, Ser. No. 614,511
Int. Cl.² B01D *17/04*
U.S. Cl. 210—22 R **11 Claims**



C-1807-77
THE TREATMENT OF WASTE EMULSIFIED OILS BY ULTRAFILTRATION
Bailey, P. A. 1977.
Filtration and Separation 14(1):53-55.

Waste oil treatment, Emulsions, Filtration, *Ultrafiltration

A semi-permeable membrane of polymeric materials was used to treat the waste oils. Under slight pressure, emulisified oil particles are retained while water molecules pass through. The principles of the method and factors which affect its performance were explored. Advantages for ultrafiltration include: little required pretreatment, no necessary chemical additions or heat input, little need for further treatment of water, no sludge formation, and an oil concentrate capable of supporting combustion. About 100 plants have installed this treatment system.

[from Selected Water Resources Abstracts 10(13):#W77-06221. 1977]

C-1808-77
ULTRAFILTRATION-THE CURRENT STATE OF THE ART
Bailey, P. A. 1977.
Filtration and Separation 14(3):213-219.

Wastewater treatment, Industries, Filtration, Oil-water separation, Emulsions, *Ultrafiltration

The ultrafiltration process is described and ten major industrial applications of the process are reviewed, including the separation of oil-water emulsions and wastewaters.

[from the UDS Quality Control Digest 8(4):III-29, #7E-131. 1977]

C-1809-77
PROCEDURE AND INSTALLATION TO COLLECT A LIGHT FLOATING MATERIAL FROM A FLUID SURFACE
(Ballast Nedam Groep NV). 1975.
Netherlands Application 7,510,152

Wastewater treatment, Waste oil, Design and engineering, Patent, *Collection reservoir

A light material such as oil is carried into a collection reservoir by the force of a fluid jet stream. The oil floats upward in the reservoir and heavier fluid is removed via exits close to the lower part of the collection reservoir.

[from Petroleum Abstracts 17(35):#237,687. 1977]

C-1810-77
APPARATUS FOR SEPARATING OIL AND SOLIDS FROM WATER
Barra, F. J., and K. R. Murrell. 1976.
Canadian Patent 995,591

Wastewater treatment, Filtration, Oil-water separation, Patent

A multichamber filtering apparatus is described which removes oil-coated solids from water, separates the solids, and recovers the oil.

[from Chemical Abstracts 86(26):#194680r. 1977]

C-1811-77
TREATMENT OF OIL-IN-WATER EMULSIONS BEFORE AND/OR DURING ULTRAFILTRATION
Beaton, N. C., and J. D. Hasledon. 1977.
British Patent 1,475,745

Oil-water separation, Emulsions, Filtration, Patent, *Ultrafiltration

An emulsion stabilizer is added to the oil-in-water emulsion and subsequently the stabilized emulsion is subjected to ultrafiltration to produce a purified ultrafiltrate.

[from Petroleum Abstracts 17(30):#235,882. 1977]

C-1812-77
FLUID BED INCINERATION OF WASTES
Becker, K. P. and C. J. Wall. 1976.
Chemical Engineering Progress 72(10):61-68.

Wastewater disposal, Sludge, Refineries, Incineration, *Fluid beds

Fluid bed incineration systems, originally developed for coal gasification, are now being applied to waste disposal problems in various industries. The article discusses applications of this technology to refinery wastewater and sludge treatment.

[from Environment Abstracts 7(4):#77-02593. 1977]

C-1813-77
PERFORMANCE OF DUAL-MEDIA - 1
Brody, M. A., and R. J. Lumpkins. 1977.
Chemical Engineering Progress 73(4):83-86.

Wastewater treatment, Oil-water separation, Filtration, Refineries, Pennsylvania, *Sand filters

The BP Oil Corporation's Marcus Hook, Pennsylvania, oil refinery is described with regard to its use of sand filters for treating refinery wastewaters. Since their installation in 1973, the sand filters have performed well, needing little maintenance and averaging about 60% removal of oil and suspended solids.

C-1814-77

EVALUATING COALESCENCE OF OIL EMULSIONS

Chieu, J. N., E. F. Gloyna, and R. S. Schechter. 1977.
Journal of the Environmental Engineering Devision, ASCE 103
(EE2):163-175. Proceedings paper 12852.

Wastewater treatment, Emulsions, Coalescence, Waste oil

The basic concepts of a laboratory unit which can be used to select filter media suitable for the coalescence of oil-water emulsions are described. System variables studies include media wettability, filtration velocity, interfacial tension, coalescer depth, and oil viscosity.

C-1815-77

OIL-WATER SEPARATION PROCESS AND APPARATUS

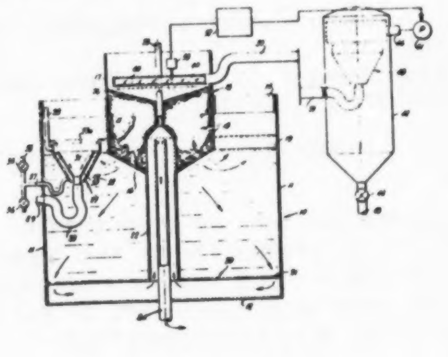
Cook, D. G. 1977.
U.S. Patent 4,011,158

Oil-water separation, Ships, Coalescence, Flotation, Design and engineering, Patent

Oily wastewaters are passed through a coalescer unit where small oil droplets combine into larger ones and coalesce into a floating layer that is removable by conventional means. The apparatus is designed to accommodate for pitching and rolling movement so that the unit can be used for shipboard oil-water separation applications.

[from Chemical Abstracts 86(26):#194683u. 1977]

4,011,158
OIL-WATER SEPARATION PROCESS AND APPARATUS
Danny G. Cook, Walnut Creek, Calif., assignor to Liquid Processing Systems, Inc., San Leandro, Calif.
Continuation-in-part of Ser. No. 465,168, April 26, 1974, abandoned. This application May 23, 1975, Ser. No. 580,537
Int. Cl.^{2} B01D *13/00*
U.S. Cl. 210—23 R 10 Claims



C-1816-77
EXTRACTION OF CHEMICAL POLLUTANTS FROM INDUSTRIAL WASTEWATERS WITH VOLATILE SOLVENTS
Earhart , J. P., K. W. Won, C. J. King, and J. M. Prausnitz. 1976.
Final report 1971-1975, EPA/600/2-76/220; Grant EPA-R-801030. 531p.

Wastewater treatment, Refineries, Contaminants, Extraction, Solvents

Solvent extraction was studied as a method for treating wastewaters from petroleum refineries and petrochemical plants. A miniplant extraction facility was used to demonstrate the capabilities of extraction for treating 7 different industrial waters and for the purpose of analyzing the underlying mass transfer and axial mixing behavior. The scale-up of the extraction system and the logic of selecting extraction processes for wastewater treatment are explored.

[from Government Reports Announcements 77(15):#PB-266 241/9GA. 1977]

C-1817-77
RECOVERY OF ORGANIC POLLUTANTS VIA SOLVENT EXTRACTION
Earhart , J. P., K. W. Won, H. Y. Wong, J. M. Prausnitz, and C. J. King. 1977.
Chemical Engineering Progress 73(5):67-73.

Wastewater treatment, Refineries, Petrochemicals, Hydrocarbons, *Solvent extraction

Solvent extraction, using light hydrocarbon solvents, was applied experimentally to the treatment of seven real wastewaters from petroleum refining and petrochemical manufacture. Results of the experiments are briefly summarized in this report and demonstrate the usefulness of this method for removing many or all major contaminants, including oil.

C-1818-77
THE REPORT TO CONGRESS: WASTE DISPOSAL PRACTICES AND THEIR EFFECTS ON GROUND WATER
Environmental Protection Agency, Office of Water Supply. 1977.
Final report, EPA/570/9-77/001. 531p.

Contaminants, Crude oil, Industries, Disposal, Groundwater, Environmental effects

This document was prepared pursuant to a section of the Safe Drinking Water Act and is an evaluation of the impact of waste disposal practices upon present and future underground sources of drinking water. The sources and pathways of pollutant substances, including crude oil, are identified.

[from Government Reports Announcements 77(13):#PB-265 081/0GA. 1977]

C-1819-77
RADIOTRACER APPLICATIONS IN PETROLEUM REFINERY POLLUTION CONTROL
Fries, B. A. 1976.
International Symposium on the Development of Nuclear-based Techniques for the Measurement, Detection and Control of Environmental Pollutants, Vienna, Austria, 1976. p.609-619.

Wastewaters, Refineries, Pollution control, *Radiotracer applications

Radiotracer procedures are probably the best way to measure flow and to study hydraulic behavior; therefore they can assist in measuring the quantities of emissions, studying the control systems, and diagnosing operating problems in petroleum refineries and petrochemical plants. Case studies are presented.

[from ERDA Energy Research Abstracts 2(12):#28693. 1977]

C-1820-77
COMPOSITION OF MICROFLORA OF ACTIVE SLUDGES PURIFYING WASTE WATERS FROM PETROLEUM REFINERIES AT ELEVATED TEMPERATURES
[in Russian]
Gasanov, M. V., L. M. Kirillova, and R. M. Subaeva. 1976.
Trudy, Bakinskii Filial Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii 12:9-12.

Wastewater treatment, Biodegradation, Activated sludge, Refineries

Biochemical purification was optimal at 37°. The predominant microorganism in the activated sludge was *Nitrobacter*.

[from Chemical Abstracts 87(8):#57968x. 1977]

C-1821-77
ELIMINATION OF OBVIOUS AND LATENT OILS
Gassmann, G. and W. Gunkel. 1977.
German Offenlegungsschriften (unexamined patent application) 2,533,775

Wastewaters, Spill cleanup, Biodegradation, Patent, *H_2O_2

H_2O_2 was added in concentrations from 0.1 to 10% to polluted areas to accelerate biological degradation of oils. H_2O_2 is useful in locations with limited air access, but may also be used on beaches and in open spaces. It is advantageous to add nitrogen and phosphorus nutrients and surfactants.

[from Chemical Abstracts 86(24):#176780u. 1977]

C-1822-77

OPTIMIZING GRANULAR MEDIA FILTRATION

Grutsch, J. F., and R. C. Mallatt. 1977.
Chemical Engineering Progress 73(4):57-66.

Wastewater treatment, Refineries, Filtration

"Chemical destabilization of colloids followed by granular media filtration is a valuable method for treating petroleum refinery effluents."

[from Chemical Abstracts 87(6):#43667m. 1977]

C-1823-77

REMOVING OIL PRODUCTS FROM WASTE WATERS BY FLOCCULATION

Gudasheva, V. M., L. A. Alferova, I. L. Mongait, and V. G. Ponomarev. 1977.
USSR Patent 545,590

Wastewater treatment, Petroleum products, Oil-water separation, Flocculation, Patent

"Polyethylenimine was added (2-5 mg/L) as a flocculant to remove oil products from wastewater."

[from Chemical Abstracts 86(22):#160741w. 1977]

C-1824-77

OIL-SEPARATING AGENT FROM EMULSION - LIKE OIL-WATER MIXTURES

Hagiwara, M., M. Mori, S. Nakai, and T. Kishima. 1977.
Japanese Kokai (unexamined patent application) 77 45,593

Oil-water separation, Emulsions, Crude oil, Patent

The agents contain ester or ether derivatives of poly(oxyalkylene) mono(alkylphenyl) ether-HCHO condensation products. When mixed with an oil-water mixture (9[illegible] crude oil), 9.5% water was separated after settling and centrifugation.

[from Chemical Abstracts 87(6):#41642a. 1977]

C-1825-77

TECHNIQUES FOR PURIFYING OILY WASTE WATER

Hale, L. C., and D. Bauer. 1977.
Plant Engineering, March 17:131-133.

Wastewater treatment, Oil-water separation, Pollution prevention, Refineries, Waste oil

Alternate recovery methods for removing oily wastes from several industrial effluents were reviewed. Refinery wastes are usually treated in gravity-type separators and then further treated in induced-air flotation units.

[from Selected Water Resources Abstracts 10(15):#W77-07213. 1977]

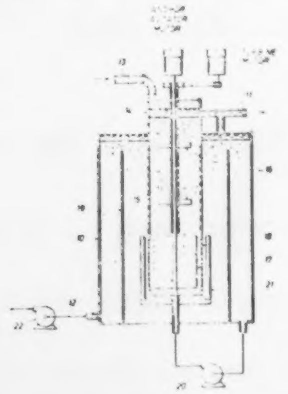
C-1826-77
METHOD AND APPARATUS FOR CONTINUOUSLY SEPARATING EMULSIONS
Heath, J. E., and W. M. Sawyer. 1977.
U.S. Patent 4,017,389

Oil-water separation, Emulsions, Coalescence, Patent, *Cellulose pulp

Cellulose pulp is used to effect coalescence in an oil-in-water emulsion. The emulsion is filtered from one chamber to another for two coalescences, and the floating oil is removed from each chamber.

[from Chemical Abstracts 87(8):#58154r. 1977]

4,017,389
METHOD AND APPARATUS FOR CONTINUOUSLY SEPARATING EMULSIONS
James E. Heath, and Webster M. Sawyer, both of Houston, Tex., assignors to Shell Oil Company, Houston, Tex.
Filed June 6, 1975, Ser. No. 584,450
Int. Cl.2 B01D *17/04*
U.S. Cl. 210—23 R **3 Claims**



C-1827-77
APPARATUS FOR SEPARATING OIL, FAT, GASOLINE AND SIMILAR LIGHT MEDIA AS SLUDGE FROM LIQUIDS
Hein, M. 1976.
Austrian Patent 332,317

Oil-water separation, Sludge, Gasoline, Wastewaters, Design and engineering, Patent

Oil and sludge are separated from wastewater by an apparatus which is mounted on a vertical outlet pipe and has a funnel for introducing the mixture into a separation zone. This zone consists of a set of cylindrical partitions that form a zigzag path for the water. Water is siphoned to the outlet pipe and oil and sludge are collected periodically.

[from Chemical Abstracts 87(2):#11125s. 1977]

C-1828-77
SEPARATION OF OIL FROM WATER
Hoketsu, H. 1976.
Japanese Kokai (unexamined patent application) 76,151,689

Oil-water separation, Coagulation, Patent, *Plastics powder

Plastics powder is dusted on oil on water and vibrated mechanically to coagulate the oil to balls.

[from Chemical Abstracts 86(24):#176790x. 1977]

C-1829-77
WATER-OIL SEPARATION FROM WATER-CONTAINING WASTE OIL
Ikeguchi, M., N. Kawakami, Y. Nagata, H. Nakagaki, and H. Ono. 1976.
Japanese Kokai (unexamined patent application) 76 96,785

Waste oil treatment, Oil-water separation, Surfactants, Patent

A coal tar-system waste oil containing water is mixed with anionic surfactants, agitated, and then centrifuged for separation.

[from Chemical Abstracts 87(4):#28545b. 1977]

C-1830-77
WASTEWATER TREATMENT AND OIL RECLAMATION AT GENERAL MOTORS, ST. CATHARINES
Johnson, R. E., Jr. 1976.
Ontario Industrial Waste Conference, Ontario, 1976. No. 23. p.345-357.

Wastewater treatment, Industries, Oil-water separation, Reclamation, Reuse, Canada

The treatment of liquid wastes from the General Motors Axle Plant in Ontario is described. Wastewaters are sieved to remove solids, allowed to stand two days to allow oils to separate, and the separated oil is then skimmed off. The pH of the emulsified oil is adjusted to 4.5 with H_2SO_4 and aluminum, and the precipitated flocculant is separated from the water using streams of air and a polyelectrolyte. The recovered oil can be refined and reused.

[from Chemical Abstracts 86(22):#160600z. 1977]

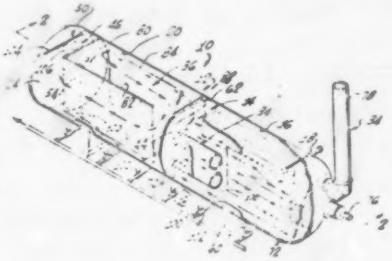
C-1831-77
EMULSION TREATER
Jones, J. A. 1977.
U.S. Patent 4,012,207

Emulsions, Crude oil, Oil-water separation, Patent

A crude oil-water emulsion such as that produced from oil wells is treated by passing the emulsion through a treatment tank which contains a preheating, direct heating, and post-heating zone. Vapor is removed at the top and water is removed at the bottom. A final settling and oil recovery zone completes the separation process.

[from Petroleum Abstracts 17(28):#235,496. 1977]

4,012,207
EMULSION TREATER
Jeffrey A. Jones, Taft, Calif., assignor to Chanslor-Western Oil and Development Company, Sante Fe Springs, Calif.
Filed Apr. 5, 1976, Ser. No. 673,588
Int. Cl.^{2} B01D *19/00*
U.S. Cl. 55—174
22 Claims



C-1832-77
TREATMENT OF WASTE WATER CONTAINING EMULSIFIED OIL
Kanamori, M. 1977.
Japanese Kokai (unexamined patent application) 77 25,455

Wastewater treatment, Emulsions, Oil-water separation, Oxidation, Adsorption, Patent

Oily wastewater is mixed with ferrous salt, neutralized with alkali, and oxidized at high temperature. An oxidizing gas is blown into the mixture to produce Fe oxide, which adsorbs the emulsified oil.

[from Chemical Abstracts 87(4):#28619d. 1977]

C-1833-77
SEPARATION OF OIL FROM WASTE WATER
Kawaguchi, N., and H. Shibata. 1977.
Japanese Kokai (unexamined patent application) 77 11,179

Wastewater treatment, Oil-water separation, Patent, *Popcorn polymer

Wastewater containing tar-type heavy oil was passed through a tower packed with an oil-absorbed popcorn styrene copolymer and fed into a separation tank. Oil and water phases occurred rapidly in separation.

[from Chemical Abstracts 87(4):#28588t. 1977]

C-1834-77
PERFORMANCE OF DUAL-MEDIA FILTERS - 2
Kempling, J. C., and J. Eng. 1977.
Chemical Engineering Progress 73(4):87-91.

Wastewater treatment, Oil-water separation, Filtration, Refineries, Canada, *Dual-media filters

Based on successful pilot plant simulation of dual media filtration, a full-scale wastewater filtration facility was installed at the Imperial Oil refinery in Sarnia, Ontario, in 1974. Twenty months of operation of the full scale filtration system have shown that the filters remove an average of 1.5 tons/day of oil and suspended solids from the refinery wastewaters.

C-1835-77
REMOVAL OF ORGANIC SUBSTANCES FROM PETROLEUM-CONTAINING WASTE WATERS
Khaimovich, B. N., N. F. Bezuglyi, N. P. Kobyzev, and A. F. Taratunin. 1977.
USSR Patent 301,053

Wastewater treatment, Flotation, Patent, *Tetraethylead removal

"For removal of tetraethylead waste waters are first treated by flotation and $KMnO_4$ is added at 0.2-1g/L."

[from Chemical Abstracts 87(2):#11160z. 1977]

C-1836-77
WASTE WATER TREATMENT AND SOLID WASTE DISPOSAL IN THE PETROLEUM INDUSTRY
Kieli, J. 1977.
Prace Naukowe Instytutu Inzynierii Ochrony Srodowiska Politechniki Wroclawskiej 32:143-162.

Wastewater treatment, Solid wastes, Refineries, Poland

This paper discusses waste purification methods for refinery plants in Poland.

[from Chemical Abstracts 87(4):#28508s. 1977]

C-1837-77
DEVELOPMENT STAGE OF SEWAGE PURIFICATION IN PETROLEUM PROCESSING AND PETROLEUM CHEMISTRY IN THE GDR [in German]
Kinder, R., and K. Gabsch. 1976.
Freiberger Forschungshefte A566:75-92.

Refineries, Oil industry, Petrochemicals, Wastewater treatment, East Germany

Methods which have been developed to meet international standards of effluent treatment in the petroleum and petrochemical industries are discussed. Cost-effective methods include mechanical clarification, flocculation, and biological activated sludge treatment.

[from Chemical Abstracts 87(2):#11053s. 1977]

C-1838-77
APPARATUS AND METHOD FOR SEPARATING IMPURITIES FROM WATER USING ULTRASONICS
Koblanski, J. N. 1977.
German Offenlegungsschriften (unexamined patent application) 2,641,330

Oil-water separation, Coalescence, Patent, *Ultrasonics

Oil floating on water can be coalesced into a continuous mass that can be drawn off by focusing ultrasonic energy on the oil-water interface. The ultrasonic energy is focused by a submerged parabolic surface toward a point at which the coalesced oil enters a separate holding chamber.

[from Chemical Abstracts 86(26):#195038z. 1977]

C-1839-77
HIGH EFFICIENCY OIL/WATER SEPARATION
Lock, J. 1976.
Processing 22(10):41.

Wastewater treatment, Oil-water separation, Coalescence, Design and engineering

The Flofoil oil-water separation process, developed by ICI Pollution Control Systems, is described. The process can remove oil droplets larger than 10μ with 97-99.6% efficiency to less than 1 ppm concentration; oil droplets smaller than 10μ can be removed with 30-60% efficiency to concentrations under 5 ppm. The system is based on the use of special coalescence filters and fabrics that are incorporated into an oil-water separator unit.

C-1840-77
TRANSFER OF ORGANICS FROM AN OIL FILM INTO WATER
Lysyj, I., and E. C. Russell. 1977.
Fate of Pollutants in the Air and Water Environments, Part 1.
I. H. Suffet (ed.). New York, Wiley, 1977. p.135-144.

Wastewaters, Oil discharges, Fuel oil, Gasoline, Lubricating oil, Monitoring, Environmental effects, *Dissolved organics

Total organic carbon analyses were performed on fuel oils, gasolines, and lubricating oils in this study concerned with monitoring and control of oily wastewater discharges. Conclusions report that the observed concentrations of water soluble petroleum derived organics exceed the "no visual sheen" limit for free oil, which is approximately 10 ppm; therefore, the discharge of oily wastewater containing dissolved petroleum matter could have adverse environmental effects. It is suggested that additional chemical and toxicological data are needed in order to establish regulations and limitations of dissolved oil in waste discharges.

C-1841-77
OIL/WATER SPLITTER SNAGS EMULSIFIED OIL (product information)
Mapco, Inc. 1977.
Chemical Engineering 84(15):77.

Oil-water separation, Wastewater treatment, Coalescence, Design and engineering, *Gravity separation

A combined gravity separation and coalescence oil/water separation system has been developed by the Mapco Process and Pollution Controls Division, Tulsa, Oklahoma. The model is available in 227-5,678 L/min (60-1500 gal/min) capacities; removes oil from a wide range of wastewater streams; and recovers floating, dispersed, and emulsified oil.

C-1842-77
BIOLOGICAL METHODS FOR DETOXICATION OF REFINERY AND PETROCHEMICAL WASTE WATERS [English summary]
Miksch, K. 1977.
Przemysl Chemiczny 56(2):67-70.

Petrochemicals, Refineries, Wastewater treatment, *Biological detoxication

"A reivew with 38 references."

[from Chemical Abstracts 86(26):#194451s. 1977]

C-1843-77
DESIGNING PARALLEL-PLATES SEPARATORS
Miranda, J. G. 1977.
Chemical Engineering 83(3):105-107.

Wastewater treatment, Refineries, Oil-water separation, *Parallel plate separators

A method has been developed for designing parallel plate separators which overcome the problems encountered in using API type oil-water separators for petroleum refinery effluents. The parallel plates interceptor (PPI) minimizes difficulties associated with space requirements, evaporation losses, construction cost, fire hazard, and high stream consumption. A theoretical design approach to the PPI is presented.

[from Selected Water Resources Abstracts 10(13):#W77-06222. 1977]

C-1844-77
FILTRATION & SEPARATION: REMOVING COLLOIDAL SOLIDS VIA UPFLOW FILTRATION
Mohler, E. F., Jr., and L. T. Clere. 1977.
Chemical Engineering Progress 73(4):74-82.

Wastewater treatment, Refineries, Filtration, Solid wastes, Design and engineering, Ohio, *Upflow sand filters

In 1972, the Sun Petroleum Company's Toledo, Ohio refinery installed a fully automatic upflow sand filtration system. After in-house improvements to the system, it now meets the 80% suspended solids removal guarantee and also removes significant quantities of other pollutants, including oil. In addition, the system enables the reuse of process waters and has dramatically decreased the amount of wastewaters discharged per barrel of crude oil processed.

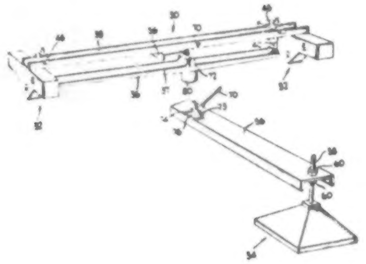
C-1845-77
AUTOMATIC OIL-WATER SEPARATION DEVICE
Morgan, J. E., W. M. Lynch, and P. M. Pelton. 1977.
U.S. Patent 4,010,103

Oil-water separation, Skimmers, Design and engineering, Flotation
Patent

The device is used within a tank for skimming the oil off the top of the water and then collecting it in a container. Included is a skimming trough supported by two flotation beams which are designed to restore the trough to the skimming position in the event the unit is submerged.

[from Petroleum Abstracts 17(23):#234,035. 1977]

4,010,103
AUTOMATIC OIL-WATER SEPARATING DEVICE
Jerry E. Morgan, 352 67th St., Clarendon Hills, Ill. 60514; William M. Lynch, 621 Western Ave., Glen Ellyn, Ill. 60137, and Paul M. Pelton, 1209 South Gates, West Chicago, Ill. 60185
Filed Aug. 12, 1974, Ser. No. 496,515
Int. Cl.² E02B *15/04*
U.S. Cl. 210--242 R 8 Claims



C-1846-77
ANALYTICAL VARIABILITY OF FIVE WASTEWATER PARAMETERS--PETROLEUM REFINING INDUSTRY
Myers, L. H., T. E. Short, Jr., B. L. DePrater, and F. M. Pfeffer. 1976.
Report EPA-600/2-76-234. 67p.

Wastewater treatment, Refineries, Chemical analysis, EPA, *Analytical variability

"The extent of analytical variability incurred for a specific industrial wastewater, e.g. petroleum refinery effluents, was detected for intralaboratory (repeatability) interlaboratory (reproducibility), and spike recovery for COD, suspended solids, ammonia-N, phenolics, and oil and grease. The Environmental Protection Agency methodology was suitable."

[from Chemical Abstracts 87(2):#11106m. 1977]

C-1847-77
LAND DISPOSAL OF OILY WASTEWATER BY MEANS OF SPRAY IRRIGATION
Neal, D. M., R. L. Glover, and P. G. Moe. 1977.
Land as a Waste Management Alternative. R. C. Loehr (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p.757-767.

Wastewater disposal, Waste oil, Reclamation, Fuels, *Land disposal, *Spray irrigation

Since 1972, over 136 million L (36 million gal) of oily wastewaters have successfully been disposed of through a land application system, and about 2.3 million L (600,000 gal) have been reclaimed in the process and used successfully as boiler fuel. The value of the salvaged oil has more than paid for the entire costs of the project to date.

[from Pollution Abstracts 8(4):#77-03258. 1977]

C-1848-77
REMOVAL OF OIL FROM WASTE WATER
Obara, G. 1976.
Japanese Kokai (unexamined patent application) 76 87,350

Wastewater treatment, Flocculation, Oil-water separation, Patent

Oil-containing wastewater is mixed with *n*-C_6H_{14}, a neutralizing agent, and two flocculants. The mixture is put into a scum separator, and heated to vaporize the *n*-C_6H_{14} from the flocs before they are removed. Vapors are recovered through cooling.

[from Chemical Abstracts 87(4):#28537a. 1977]

C-1849-77
REMOVAL OF OIL FROM WASTE WATER
Obara, G. 1976.
Japanese Kokai (unexamined patent application) 76 87,351

Wastewater treatment, Flocculation, Oil-water separation, Patent

A neutralizing agent is mixed with oily wastewater while air is blown into the mixture, and two flocculants are added. The wastewater is then put into a scum separator where the floating flocs are removed by oscillating blades.

[from Chemical Abstracts 87(4):#28536z. 1977]

C-1850-77
WASTEWATER TREATMENT
Okumura, M., and K. Sukai. 1976.
Japanese Kokai (unexamined patent application) 76 78,066

Wastewater treatment, Emulsifiers, Sludge, Adsorption, Flotation, Patent

A fibrous agent is made from oil emulsion-treatable fine inorganic particles or an organic polymer. It adsorbs sludge material in wastewater during an air flotation treatment process. The method removes emulsifier oils, has excellent filterability, and needs no pH control.

[from Chemical Abstracts 87(8):#58081q. 1977]

C-1851-77
WASTEWATER TREATMENT BY COAGULATION
Okumura, M., and K. Sukai. 1976.
Japanese Kokai (unexamined patent application) 76 79,959

Wastewater treatment, Coagulation, Patent

The agent described consists of emulsified-oil-treating inorganic particles and/or organic polymers. Any volume of wastewater can be treated by this method, using only a precipitation tank and stirring tank.

[from Chemical Abstracts 87(8):#58085u. 1977]

C-1852-77
BREAKDOWN OF STABLE PETROLEUM EMULSIONS [in Russian]
Pozdnyshev, G. N., and M. V. Shmelev. 1977.
Neftyanoe Khozyaistvo 1977(2):51-54.

Emulsions, Oil-water separation, Crude oil

"Stable oil-in-water and water-in-oil emulsions were broken by feeding 50-100 g Disolvan 4411 ton crude oil."

[from Chemical Abstracts 87(8):#55380a. 1977]

C-1853-77
COMPOSITION FOR SEPARATING HYDROCARBONS FROM WATER
Preus, P. 1977.
U.S. Patent 4,011,175

Wastewater treatment, Spill recovery, Oil-water separation, Absorption, Patent, *Sorbent material

Oil is removed from wastewater or absorbed from spills by adding a comminuted mixture consisting of expanded perlite, asphalt, clay and cellulose fibers, having a particle size < 0.64 cm (0.25 in) and density approximately 80 kg/m^3 (4.5 lb/ft^3). The material floats on water after oil absorption and can absorb oil at a rate of about 75-125 L/kg (9-15 gal/lb).

[from Chemical Abstracts 86(26):#195020n. 1977]

C-1854-77
SEPARATION OF EMULSIONS BY FLOTATION WITH DISSOLVED AIR
Rovel, J. M., and M. Cordier. 1976.
French Demande 2,300,620

Wastewater treatment, Emulsions, Oil-water separation, Flotation, Patent, *Cationic polymers

Wastewater that contains petroleum oil in droplets ($<30\mu$ in diameter) is treated separately with two cationic polymers for comparison and then subjected to air flotation.

[from Chemical Abstracts 87(4):#28591p. 1977]

C-1855-77
ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES IN THE PETROLEUM REFINING INDUSTRY
Sanjour, W., E. Weisberg, and H. Cruse. 1976.
National Petroleum Refiners Association Annual Meeting, 1976. Paper AM-76-33. 22p.

Refineries, Contaminants, Wastewaters, Solid wastes, Disposal, Inland, *Waste disposal practices, *Landfills

In this study of potentially hazardous wastes of the petroleum industry, all waste streams investigated were found to be potentially hazardous in their content of at least one significant trace element. Disposal to secure landfills or land farms was judged to provide a simple, economical, and environmentally adequate waste disposal technique.

[from The Engineering Index Monthly 15(6):#042619. 1977]

C-1856-77
WASTE WATER TREATMENT BY REVERSE OSMOSIS. IV. PRACTICAL EXAMPLE OF WASTE WATER TREATMENT
Sato, T., H. Motomura, and Y. Taniguchi. 1976.
Kagaku Kojo 20(11):72-73.

Wastewater treatment, Refineries, *Reverse osmosis, *Water recovery

Reverse osmosis methods were used to recover water discharged by an oil refinery. The water recovery rate was 90%.

[from Chemical Abstracts 86(26):#194612v. 1977]

C-1857-77
DEVELOPMENT AND IMPLEMENTATION OF AN IMPROVED WASTE WATER TREATMENT SYSTEM AT IMPERIAL'S SARNIA REFINERY
Schindel, G. W. 1976.
Proceedings of the Ontario Industrial Waste Conference, Vol. 23: 202-230.

Refineries, Wastewater treatment, Filtration, Water quality, Ontario

Improved wastewater treatment at an Ontario, Canada, refinery resulted in a reduction of process wastewaters from about 57,000 to 11,000 L/min (15,000 to 3,000 gpm), and a significant improvement in effluent quality. An improved dual mode filter was installed which reduced suspended oils in the effluent by 79% and suspended solids by 53%.

[from Chemical Abstracts 87(2):#11024h. 1977]

C-1858-77
SOLVENT RECOVERY FROM SCUM IN OIL-CONTAINING WASTE WATER TREATMENT
Shishido, N., T. Hirano, H. Tsuchiya, and K. Sakaki. 1976.
Japanese Kokai (unexamined patent application) 76 96,778

Wastewater treatment, Flocculation, Solvents, Oil-water separation, Patent, *Solvent recovery

Oil-containing waste water is treated with an organic solvent and a flocculant before steam is blown into the scum layers. After separation the solvent is recovered by distillation. Recovery time was twice as long when steam was not used.

[from Chemical Abstracts 87(4):#28546c. 1977]

C-1859-77
SOLVENT RECOVERY FROM SCUM IN OIL-CONTAINING WASTE WATER TREATMENT
Shishido, N., T. Hirano, H. Tsuchiya, M. Masuda, and K. Sakaki. 1976.
Japanese Kokai (unexamined patent application) 76 96,781.

Wastewater treatment, Solvents, Flocculation, Oil-water separation, Patent, *Solvent recovery

After oily wastewater is treated with an organic solvent and a flocculant, a water-soluble inorganic salt is added to the scum layers. The scum is separated, mixed with NaCl, and distilled for solvent recovery.

[from Chemical Abstracts 87(4):#28547d. 1977]

C-1860-77

HEAVY-EMULSION OIL WASTE REDUCED FROM 2000 TO 10 PPM

Smith, A. W., and K. Robe. 1976.
Chemical Processing 39(12):62.

Waste oil treatment, Emulsions, Refineries, Design and engineering

An air flotation system was designed to handle the previously untreatable heavy oil emulsions in wastewaters from the Champlin Petroleum Company refinery. Tests in a pilot unit showed a 90-95% oil removal under varying loads of oil emulsion, and a 1900 L/min (500 gpm) unit was subsequently installed.

[from Environment Abstracts 7(4):#77-02604. 1977]

C-1861-77

CRUDE OIL PRETREATMENT AND ENVIRONMENTAL PROTECTION

Sorkin, Ya. G. 1975.
Chemical Technology of Fuels and Oils (USSR) 11(11-12):913-915.

Wastewater treatment, Crude oil, Refineries, Cost analysis, Economics, USSR

Removal of oil and salts from wastewaters in the refinery requires the construction of expensive treating units. In order to calculate the cost for oil pretreating and emulsion wastewater treating and to determine how these costs are affected by the salt content of the oil entering the refinery, the author has used averaged technoeconomic indices for the operation of a number of USSR refineries in the processing of one million tons of Romashkino crude. Cost data of crude oil pretreatment are tabulated and discussed.

[from ERDA Energy Research Abstracts 2(11):#25903. 1977]

C-1862-77

COALESCENCE OF OIL-IN-WATER SUSPENSIONS BY FLOW THROUGH POROUS MEDIA

Spielman, L. A., and Y. P. Su. 1977.
Industrial and Engineering Chemistry, Fundamentals 16(2):272-282.

Wastewater treatment, Oil-water separation, Wastewaters, Coalescence

This work attempts to resolve aspects of major disagreement regarding the separation of finely disposed liquid-liquid suspensions, and sets down equations governing coalescence of oil by both granular and fibrous media.

[from Petroleum Abstracts 17(34):#237,299. 1977]

C-1863-77

COMBINED BIOLOGICAL TREATMENT AND UNDERGROUND INJECTION OF REFINERY WASTE WATER

Sutterfield, F. D., E. C. Donaldson, and F. S. Manning. 1976.
National Conference on Complete Water Use, Chicago, 1975. 26p.

Wastewater treatment, Disposal, Refineries, *Biological treatment, *Underground waste injection

The biological treatment and underground waste injection systems for petroleum refinery wastewaters are described, and a possible redesign of the biological unit is presented. Both treatment systems meet current legal requirements for waste processing, and the combined system is more economical than treatment in a single biological system.

[from ERDA Energy Research Abstracts 2(10):#24022. 1977]

C-1864-77

IMPROVEMENT IN THE FLOTATION SEPARATION OF FINELY EMULSIFIED OILS FROM WASTE WATERS [in Russian]

Sviridov, V. V., T. F. Kokovkina, V. G. Vshivtsev, and L. D. Skrylev. 1976.
Koks i Khimiya No. 11:38-40.

Wastewater treatment, Oil-water separation, Emulsions, Flotation

Flotation removal of oils requires 30-70 mg $FeSO_4$/L. Problems resulting from the use of inorganic salt were eliminated by using ultrasonically dispersed 1-5 mg/L of undecyl-, tridecyl-, or cetylpyridine chloride. Residual concentration of oils was lowered to 10-30 mg/L.

[from Chemical Abstracts 86(24):#176666m. 1977]

C-1865-77

TAXONOMICAL AND ECOLOGICAL STUDY IN AN OXIDATION POND SYSTEM ESTABLISHED FOR THE TREATMENT OF OIL INDUSTRY WASTE WATER

Szabo, J., G. Lakatos, M. Tokar, J. Katai, and A. Nagy. 1976.
Acta Biologica Debrecina 13:199-214.

Oil industry, Wastewater treatment, Oxidation

The system studied uses a preliminary settling tank, stabilization, pond, and final settling tank. Hydrobiological investigations report on the O budget, loading, and the calculated efficiency.

[from Chemical Abstracts 87(6):#43725d. 1977]

C-1866-77
OIL ABSORBENT
Takeda, N., H. Maki, and E. Ishimaru. 1976.
Japanese Kokai (unexamined patent application) 76,121,494

Wastewater treatment, Petroleum products, Absorption, Patent, *Absorbent polyolefin

Polyolefin of cohesive energy d < 60 is used to absorb oil dispersed in water. In a test, water samples containing 100 ppm heavy oil, turbine oil, or kerosine were reduced to 1, 1, and 3 ppm of the pollutants after addition of the material.

[from Chemical Abstracts 87(2):#11430n. 1977]

C-1867-77
REMOVAL OF OIL FROM WASTE WATER
Tomita, Y. 1976.
Japanese Kokai (unexamined patent application) 76,138,055

Wastewater treatment, Flocculation, Surfactants, Oil-water separation, Patent

Oily wastewater at a stable emulsion state is mixed with an inorganic salt, a flocculant, and/or an electrolytic surfactant, then exposed to ultrasound waves. After settling, the floated oil is removed.

[from Chemical Abstracts 87(4):#28575m. 1977]

C-1868-77
PHYSICO-CHEMICAL PURIFICATION OF PETROLEUM-CONTAINING WASTE WATERS [in Russian]
Vasilenko, I. I., V. Yu. Shchepanyuk, N. A. Sukhoverkhova, and A. P. Ivanenko. 1976.
Neftepererabotka i Neftekhimiya (Kiev) 14:92-94.

Wastewater treatment, Petroleum products, *Coagulation

"Wastewater containing 34.5 mg/L petroleum products was coagulated (optimum efficiency of flotation 76%) by 0.2 g/L of aluminum ammonium sulfate."

[from Chemical Abstracts 87(2):#11058x. 1977]

C-1869-77
SEPARATING OIL-IN-WATER EMULSIONS INTO THEIR OIL AND WATER COMPONENTS
Von Preen, W. 1977.
German Offenlegungsschriften (unexamined patent application) 2,528,990

Wastewater treatment, Oil-water separation, Emulsions, Filtration, Patent, *Ultrafiltration

A two stage method for separating oil-water emulsions is described which involves first heating the emulsion under pressure above the boiling point, and then applying ultrafiltration methods.

[from Chemical Abstracts 87(2):#8038k. 1977]

C-1870-77
REMOVAL OF LIPOPHILIC POLLUTANTS IN WATER TREATMENT [English summary]
Weil, L., H. Berger, and K. E. Quentin. 1976.
Dechema Monographs 80(1616-1638):105-114.

Petroleum products, Wastewater treatment, Flocculation

A new process for removing lipophilic substances, including petroleum products, from wastewaters is described and its effectiveness is compared with currently available methods. The new process involves the addition to water of a novel type of PE suspension, which is free from emulsifiers and other substances, and subsequent flocculation.

[from The Engineering Index Monthly 15(7):#053708. 1977]

C-1871-77
SEPARATION OF FREE OIL FOLLOWING COALESCENCE
Wu, C. J., R. S. Shechter, J. F. Malina, Jr., and E. F. Gloyna. 1977.
University of Texas at Austin, Center for Research in Water Resources, Report CRWR-143. 105p.

Wastewater treatment, Emulsions, Coalescence, Oil-water separation

Oil was coalesced by passing a stable oil-in-water emulsion through a polyester felt mat, and then removed by a separator. The method reduced concentrations of 50 mg/L oil to 1 mg/L. Six mechanical separators were evaluated for efficiency and headloss.

[from Chemical Abstracts 87(4):#28805m. 1977]

C-1872-77
STUDIES OF THE POSSIBILITY OF USING POLISH RAW MATERIALS AS SORBENTS IN SETTLING FILTRATION [English summary]
Zagorski, K., W. Strzelczyk, and J. Bankowska. 1975.
Biuletyn Lubelskiego Towarzystwa Naukowego, Matematyka-Fizyka-Chemia 17(1-2):53-57.

Wastewater treatment, Emulsions, Adsorption, Filtration, Poland, *Cellulose, *Diatomaceous earth

Domestic raw materials were evaluated as sorbents in the filtration of oily waters and emulsions. Cellulose or diatomaceous earth suspensions in water are almost as effective as a commercial product. A suspension of activated C-cellulose mixture has the highest oil adsorption capacity.

[from Chemical Abstracts 87(2):#11019k. 1977]

6. RECLAMATION AND REUSE

C-1873-77
LOW-COST ANSWER TO OIL RECYCLING?
Anon. 1977.
Factory Management 10(1):32-33

Waste oil, Lubricating oil, Recycling, Filtration, Coalescence

The high cost of recycling used lubricating and other oils can be lowered by use of a new system which combines filtration and coalescence technologies to first separate oil and water and then remove solids and separate purified oil fractions and gases. Examples of usage of this system are given.

[from The Engineering Index Monthly 15(7):#049942. 1977]

C-1874-77
NEW, MORE ATTRACTIVE ROUTE TO LUBE OIL RECOVERY
Anon. 1976.
Process Engineering, December: 6

Reclamation, Lubricating oil, Waste oils, *IFP process

A new Institute Francais du Petrole process for reclaiming used lubrication oil is claimed to solve several problems which until now have hindered reprocessing. The JFP process avoids acid treatment of oil (9-18% sulfuric acid is used in most conventional methods) and shows a considerable increase in the yield of usable products and a marked decrease in waste sludges and clay.

C-1875-77
OIL RECOVERY SYSTEM ALLOWS RE-USE OF FUEL (PRODUCT INFORMATION)
Anon. 1977.
Water & Pollution Control 115(2):31.

Spill recovery, Waste-water treatment, Oil-water separation, Crude oil, Fuels

The Scavenger oil recovery system, developed by Oil Recovery Systems, is an oil-water separation system designed to recover 99% water-free oil at rates exceeding 18 L/min (5 gpm). The system effectively recovers thin slicks or thick layers and works best with light crude oil, No. 2 fuel oil, diesel oil, gasoline, and jet fuel. The unit is portable for spill recovery applications or can be permanently installed in wastewater treatment facilities. The system is available from Marine Equipment Ltd., Halifax, Nova Scotia.

C-1876-77
RECOVERY OF USED INDUSTRIAL OIL
Anon. 1977.
Petroleum Review 31(361):15-16

Waste oil, Reclamation, Reuse, Economics

The recovery and reconditioning of waste oils by industries is recommended as a means of saving new oil costs and staying within the law. Used oil can be reclaimed and reconditioned so that it performs exactly like new oil.

[from The Engineering Index Monthly 15(6):#041251. 1977]

C-1877-77
WASTE OIL BURN-OFF IN COAST GUARD POWERPLANTS. WASTE OIL FILTERING SYSTEMS AND DIESEL ENGINE PERFORMANCE
Hobbs, J. R., and R. A. Walter. 1976.
Final report, TSC-USCG-76-1; USCG-D-78-76. 58 p.

Waste oil, Lubricating oil, Reclamation, Filtration, Oil-water separation, Fuels, *USCG powerplants

In testing waste lubricating oils as possible fuel in U.S. coast Guard powerplants, waste oil cleanup systems were evaluated. A filtration pack was found to be more effective than oil-water separation methods. Up to 10% waste lube oil was used with fuel oil, with no short-term adverse effects on emissions and powerplant engine performance.

[from Scientific and Technical Aerospace Reports 15(11): #N77-20630. 1977]

C-1878-77
UTILIZATION OF WASTE IN PULP, PAPER, SUGAR, PETROLEUM AND AGRO-BASED INDUSTRIES
Iyengar, M. S. 1976.
Chemical Age India 27(12):1045-1051.

Industries, Refineries, Wastewaters, Reclamation, Reuse, India

Wastes from various industries are reviewed and methods developed in India and covered by Indian patents for the effective utilization of wastes are outlined.

[from Chemical Abstracts 87(2):#10994n. 1977]

C-1879-77
WASTE OIL RECOVERY. X
Kawase, Y. 1976.
Sekiyu To Sekiyu Kagaku 20(11):76-80

Waste oil, Reclamation, *Review

"A review with 5 references."

[from Chemical Abstracts 86(26):#192113j. 1977]

C-1880-77
WASTE OIL RECOVERY. XI
Kawase, Y. 1976.
Sekiyu To Sekiyu Kagaku 20(10):82-86.

Waste oil, Reclamation, *Review

"A review with 5 references."

[from Chemical Abstracts 86(26):#192112h. 1977]

C-1881-77
THE GARRETT OIL-FROM-WASTE PROCESS AND RESOURCE RECOVERY SYSTEM
Titlow, E. T., and J. K. McCartney. 1975.
Energy and the Environment. Dayton, Ohio. American Institute of Chemical Engineers, 1975. p. 192-198. Proceedings of the Third National Conference, Oxford, Ohio, September 29-October 1, 1975.

Waste oil, Petroleum products, Reclamation, Reuse

A system and flowsheet for the recovery of secondary resources (including petroleum) from municipal wastes are described. The principal products recovered, process economics, and the unit operations are discussed.

[from International Aerospace Reports 17(15):#A77-35162. 1977]

7. PERSONNEL TRAINING AND EDUCATION

C-1882-77
IF THERE'S AN OIL SPILL, WE'RE READY
Glenn, M. C. 1977.
Petroleum Today 18(2):16-20.

Personnel training, Spill cleanup, Pollution control, Texas, *Oil Spill Control Course

The Oil Spill Control Course, taught at Texas A&M University's facilities in Galveston, Texas, is described and illustrated.

The course, offered at least 20 times per year, provides seminar instruction in the latest methods of spill containment and control, both on land and in water. Extensive field exercises give students the opportunity to work with modern oil spill equipment in spill simulations.

C-1883-77
OIL SPILL CONTROL TRAINING
Payne, J. L. 1977.
Ecolibrium 6(3):7-8.

Personnel training, Oil spills, Pollution control, Contingency planning, *Spill Control Course

The Oil Spill Control Course conducted by Texas A&M University's Engineering Extension Service at Galveston is described. The program covers spill prevention, control, and cleanup measures and especially emphasizes the need for an effective response when a spill has occurred. The course augments classroom presentations with field exercises and frequent informal discussion sessions in order to optimize active learning.

C-1884-77
BLOWOUT SCHOOL TEACHES PREVENTION, CONTROL
Speer, L. 1977.
Offshore 37(8):138-142.

Blowout prevention, Personnel training, *Blowout school

The University of Oklahoma blowout prevention school at Norman, Oklahoma, one of two such schools in the U.S. is preparing a special class in offshore well control for the fall of 1977. The OU Blowout School will act in liaison with a third school in California at Ventura College, planning to open August, 1977.

8. CONTINGENCY PLANNING

C-1885-77
HISTORY OF THE FORMATION OF AN OIL SPILL CONTINGENCY ORGANIZATION
Barker, C. D. 1977.
Annual SPE of AIME California Regional Meeting, 47th, Bakersfield, 1977. Paper no. SPE-6518. 2 p.

Contingency planning, Oil industry, Oil-gas leasing, OCS, Southern California

Southern California-Petroleum Contingency Organization (SC-PCO) was formed as an unincorporated joint venture in April, 1976, by the petroleum companies involved in the federal leasing program of the Outer Continental Shelf. The work covers a monthly diary describing initial funding, purchase of equipment, field testing, and related topics.

[from Petroleum Abstracts 17(33):#237,022. 1977]

C-1886-77
OIL SPILL CLEANUP--WHAT ARE THE CAPABILITIES?
Kendrick, P. J. 1977.
Journal Water Pollution Control Federation 49(5):733-736.

Contingency planning, Spill cleanup, USCG, EPA

The author reviews the National Oil and Hazardous Substances Pollution Contingency Plan (1972) and the roles played by EPA, USCG, oil spill cooperatives, and private companies in oil spill cleanup. It is concluded that substantial efforts have been made in recent years to improve strategies for handling pollution emergencies.

C-1887-77
FORWARD PLANNING
Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters
J. Wardley-Smith (ed.), London, Graham & Trotman Ltd., 1976.
p. 203-218.

Contingency planning, Spill cleanup, Personnel training, UK, U.S., Europe

The problems of organization for effective spill response are outlined with reference to West European practice and United States practice. In the UK for example, spill cleanup is carried out by the marine branch of the Department of Trade; in the U.S. the spiller is made responsible for cleanup, supervised by an on-scene commander from the U.S. Coast Guard or the Environmental Protection Agency. Contingency planning, and the organization and training of spill response personnel are discussed.

9. PREVENTION AND CONTROL MEASURES

C-1888-77
AVOIDING CONTAMINATION OF THE SEA [in Spanish]
Anon. 1977.
Petroleo International 35(5):25-26.

Pollution prevention, Offshore drilling, Emulsions, *Drilling muds, Design and engineering

A system developed by Petrobras permits extensive use of inverted emulsion muds in offshore locations without the risk of harming marine life. An efficient drill-cutting scrubber is used in the apparatus.

[from Petroleum Abstracts 17(32):#236,715. 1977]

C-1889-77
CANNED BY THE EXPERTS
Anon. 1977.
Canadian Shipping and Marine Engineering 48(5):5-6

Pollution prevention, Oil spills, Tankers, Oil tanks, *Tin can containers

A. Thorhill believes that he has discovered a way to prevent oil spills at sea. According to his idea, tankers would carry their cargoes in huge tin cans rather than in fixed ship tanks; and these cans could be discharged to float independently should the ship sink or run aground. Experts state that while the idea is feasible it is not economical.

[from Aquatic Science & Fisheries Abstracts 7(6):#7Q7579. 1977]

C-1890-77
THE GLACIER-PILGRIM 'COASTGUARD' STERNGEAR SYSTEM (product information)
Anon. 1976.
Shipping World & Shipbuilder 169(3921):761.

Ships, Leakage, Pollution prevention, *Sterngear seal system

The Glacier Metal Co. Ltd., Deep Sea Seals Ltd., and Pilgrim Developments Ltd. have developed an aft shaft seal system which is designed to eliminate oil leakage and meet antipollution laws. The design and functioning of the system are described.

[from Oceanic Abstracts 14(3):#77-02700. 1977]

C-1891-77
SPECIAL: OFFSHORE GREENLAND. SAFETY FIRST WHEN DRILLING
Anon. 1977.
Danshore 2(3):36-37.

Offshore drilling, Safety, Pollution prevention, Arctic, *Icebergs, Greenland

Icebergs constitute a serious danger to drilling operations in the arctic waters off Greenland. When icebergs come too close, they can completely destroy a drilling or production platform; therefore these installations must be protected to prevent large-scale oil pollution.

[from Petroleum Abstacts 17(28):#235,458. 1977]

C-1892-77
WAYS TO REDUCE OIL SPILLS RECOMMENDED (news brief)
Anon. 1977.
Sierra Club Bulletin 62(3):37
Pollution control, Oil spills, USCG.

Sierra Club representatives have recently suggested that the U.S. consider establishing a 320 km (200 mi)-wide pollution control zone to protect the marine resources now covered by the fisheries jurisdiction zone. Changes in the U.S. Coast Guard bureaucracy are urged to better effect its role in combatting pollution.

C-1893-77
RAM TYPE BLOWOUT PREVENTION
Arzumanov, S. A., A. A. Danieliants, K. S. O. Aliverdizade, *et al*. 1977.
British Patent 1,478,724

Blowout prevention, Drilling, Design and engineering, Patent

The elements which comprise the blowout preventer are listed.

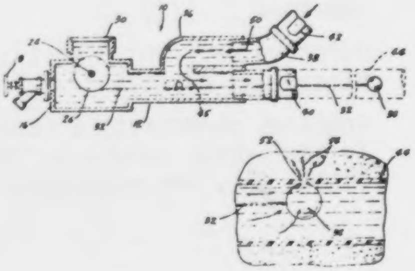
[from Petroleum Abstracts 17(34):#237,177. 1977]

C-1894-77
PIPELINE LEAK LOCATOR AND METHOD
Boyens, V. C. 1977.
U.S. Patent 4,016,748

The method consists of flowing a fluid through a conduit at superatmospheric pressure, placing within the conduit a floatable leak sensor which is responsive to pressure and velocity differentials caused by a leak, and moving the leak sensor through the conduit along with the fluid, whereby the sensor stops movement through the conduit at the location of a leak. The components of the leak sensor are described.

[from Petroleum Abstracts 17(35):#237,658. 1977]

4,016,748
PIPELINE AND LEAK LOCATER AND METHOD
Virgil C. Boyens, R.R. 1, Denison, Iowa 51442
Filed Nov. 10, 1975, Ser. No. 630,694
Int. Cl.² G01M *3/28*
U.S. Cl. 73—40.5 R **11 Claims**



C-1895-77
INSTALLATION TO REPAIR DAMAGED PIPELINES
(British Petroleum Company, Ltd.) 1976.
Netherlands Application 7,606,010

Pipelines, Leakage, Pollution prevention, Design and engineering, Patent

A compressible closing element is pressed by a bracket against the surface of the pipeline. A longitudinal flexible assembly then is placed around the pipeline, and brought under tension in order to exercise a radial inward pressure on the bracket and closing element. There are means to exercise a pulling force on the longitudinal flexible assembly.

[from Petroleum Abstracts 17(25):#234,774. 1977]

C-1896-77
OIL DISTRIBUTION AND WATER POLLUTION [English summary]
Chirac, M. 1977.
Techniques et Sciences Municipales 3:87-92.

Oil transport, Tankers, Pipelines, Pollution prevention, Spill recovery

This paper describes legal precautions for avoiding oil spills at dumps and during transport by tank-wagon, barge, or pipeline. Emergency equipment for containment and recovery is available in case of crashes.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10599. 1977]

C-1897-77
SLIP RINGS - CRUCIAL COMPONENTS FOR DEVELOPING EFFECTIVE BOP SYSTEMS
Cook, L., and J. M. Vanhoozier. 1977.
Offshore 37(9):53-56.

Pollution control, Blowout prevention, *Slip rings, *Equipment

The authors review slip ring development and its major uses. The slip ring, sometimes called an electrical swivel, has been essential in electrical distribution equipment which makes deep sea drilling possible and in particular, for blowout preventer (BOP) control techniques.

C-1898-77
CLEAN SOUND--A SUCCESSFUL OIL SPILL COOPERATIVE
Doolittle, J. C. 1977.
Ecolibrium 6(3):9-11.

Spill cleanup, Contingency planning, Puget Sound, Oil Industry, *Oil spill cooperative

Clean Sound, a cooperative oil spill response group active in the Puget Sound area, is described and its inception and development since 1971 is detailed. With their access to specialized equipment and trained manpower, oil spill cooperatives represent a way to reduce oil spill damage in a manner satisfactory to industry, the public, and governmental agencies.

C-1899-77
ENERGY RESOURCE EXTRACTION; OIL AND GAS PRODUCTION
Dorrler, J. S. 1976.
National Conference on Health, Environmental Effects, and Control Technology of Energy Use. Cincinnati, U.S. Environmental Protection Agency, 1976. p. 186-191.

Production, Pollution prevention, Oil spills, Detection, Leakage, Pipelines

New methods to improve petroleum emulsion breaking, waste minimization for offshore oil facilities, and oil spill prevention are needed. The detection of small pipeline leaks also needs more sensitive methods.

[from Chemical Abstracts 86(24):#173815y. 1977]

C-1900-77
ESTUARINE POLLUTION CONTROL AND ASSESSMENT. PROCEEDINGS OF A CONFERENCE. VOLUME I, and II
Environmental Protection Agency, Office of Water Planning and Standards. 1977.
Final report, EPA/440/1-77/007. 760 p.

Pollution control, Estuaries, *Conference

The report provides information to be used in establishing a national program for the prevention, abatement, and elimination of pollution in estuaries with emphasis on heavy metals and oil pollution. Individual papers of the report address important estuarine problems by presenting up-to-date knowledge and experience in this field.

[from Government Reports Announcements 77(14):#PB-265 467/1GA. 1977]

C-1901-77
PROCESS AND APPARATUS FOR DETECTING A FLUID LEAK FROM A PIPELINE
Jouve, P. 1977.
Belgian Patent 823, 862

Leakage, Pipelines, Detection, Design and engineering, Patent

The process consists of continuously comparing the pressure difference between the differential pressure in the pipeline and a reference pressure and a predetermined threshold pressure. The threshold pressure is the line pressure at the start of each cycle of comparison.

[from Petroleum Abstracts 17(27):#235,244. 1977]

C-1902-77
OIL SPILLS: ISSUES AND ACTIONS
Leitzell, T. L. 1977.
Marine Technology Society Journal 11(1):26-29.

Oil spills, Tankers, Oil discharges, Safety, Pollution control, Liability, International conventions

Problems of marine oil pollution by tanker spills and accidental or intentional vessel discharges are reviewed. The author believes that vessel-caused pollution can be easier to control than many other sources if certain problems are overcome. Areas discussed are safety in vessel construction, equipment and operation, spill cleanup, damage compensation, and liability assignment. The study explores recent international legislation dealing with these problem areas.

[from Petroleum Abstracts 17(29):#235,724. 1977]

C-1903-77
Title not translated [English summary]
Murzakaev, F. G. 1976.
Gigiena i Sanitariya No.7:7-10.

Refineries, Petrochemicals, Pollution control, Wastewaters, Water quality, Rivers, USSR

Improvements in the water quality downstream from oil refining and petrochemical plants along the Belaya River, USSR, are described. These industries have taken measures to decrease consumption and discharge of water, and to decrease pollution of the water with oil, petroleum products, and other compounds.

[from Pollution Abstracts 8(4):#77-03222. 1977]

C-1904-77

OIL PROTECTION IN THE NORTH SEA
Read, C. M. 1977.
Ship & Boat International 30(5):31-32.

Blowouts, Statistical analysis, Environmental protection, Economic effects, North Sea

The statistical likelihood of a blow-out occurring in the North Sea is considered. Economic effects are discussed and there is disagreement as to which cleanup methods and equipment would be most effective.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10598. 1977]

C-1905-77

OIL SPILL COUNTERMEASURES - THE BEAUFORT SEA AND THE SEARCH FOR OIL
Ross, S. L., W. J. Logan, and W. Roland. 1977.
Canada Department of the Environment, Beaufort Sea Project overview report. 67 p.

Oil spills, Pollution control, Arctic, Beaufort Sea, *Spill countermeasures

This report includes the "State-of-the-art" of oil spill countermeasures for arctic waters and is a digest of Beaufort Sea technical reports on the topic. The Beaufort Sea Project, a set of arctic marine environmental studies, was conducted during the years 1974 and 1975 in order to assess the possible impact of offshore exploratory drilling in the Beaufort Sea.

[from Beaufort Sea Project Office, Institute of Ocean Sciences, 9860 West Saanich Rd., Sidney, B. C. Canada V8L 352]

C-1906-77

THE CONTROL OF OIL POLLUTION ON THE SEA AND INLAND WATERS
Wardley-Smith, J. (ed.) 1976.
London, Graham & Trotman Ltd., 1976. 240 p.

Pollution control, Oil spills, Oceans, Inland, Environmental effects, Spill cleanup

This book explains the effect of oil spills on the marine environment and describes the best methods of cleaning up such pollution. The contents are divided into four main topics: (1) Oil and its Effects; (2) Treatment of Oil on Water; (3) Treatment of Oil on the Land; (4) Organizational Aspects.

C-1907-77
THE FUTURE
Wardley-Smith, J. 1976.
Control of Oil Pollution on the Sea and Inland Waters,
J. Wardley-Smith (ed.). London, Graham & Trotman, Ltd.,
1976. p. 219-223.

Spill cleanup, Dispersants, Environmental effects, Pollution control

In spite of many recent developments in the field of oil spill cleanup, mechanical methods are ineffective in all but calm waters. Dispersants appear to be the only effective overall method available now and in the near future. Although the effects of oil pollution are now considered less serious and long-lasting than previously thought, the prevention and control of oil pollution will continue to receive high priority in the future.

C-1908-77
THE U.S. COAST GUARD AND THE CONTROL OF OCEANIC POLLUTION
Williams, H. D. 1976.
U.S. Naval Institute. Proceedings 102 (879):146-159.

Legislation, Pollution prevention, Oil spills, Law enforcement, USCG

The author discusses the role of recent legislation and the U.S. Coast Guard in environmental protection. Methods for enforcing oil pollution prevention are developed, including a proposal for biennial inspection of crude oil tankers. Several oil spill incidents, response activity by the USCG National Strike Force, and new equipment are also reviewed.

C-1909-77
WAYS OF PREVENTING POLLUTION OF THE BIOSPHERE DURING THE OPERATION OF SHIPS [in Russian]
Yuditskii, F. L. 1976.
Sudostroenie (Leningrad) No. 3:17-22.

Ships, Oil discharges, Oil spills, Leakage, Pollution prevention

The following topics are discussed: air pollution and control exhaust gases and petroleum vapors; discharge of hold, ballast and other waters polluted by petroleum products into rivers, seas, and oceans; and leakages and spillages of petroleum and petroleum products during shipwreck. The maximum allowable concentration is 100 mg/L of seawater.

[from Chemical Abstracts 86(24):#176814h. 1977]

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

C-1910-77
Untitled. (Book review)
Anon. 1977.
Chemical Engineering 84(17):15-16.

Oil spills, Environmental effects, Toxicity, Marine organisms

The book, Marine Ecology and Oil Pollution [J. M. Baker (ed.). Barking, Essex, U.K., Applied Science Publishers Ltd., 1976], is called a "comprehensive review" of British oil pollution events and related research occurring since 1971. Environmental effects of the oil industry at Milford Haven are stressed; the book also includes a global review of oil spills and their damage from 1960 to 1975.

C-1911-77
EFFECTS OF EXTERNAL APPLICATIONS OF FUEL OIL ON HATCHABILITY OF MALLARD EGGS
Albers, P. H. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 151-157. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Fuel oil, Birds, Biological effects, *Hatchability, *Mallard duck eggs

Mallard eggs were coated with varying amounts (up to 50 μL) of No. 2 fuel oil and artificially incubated along with controls and eggs coated with other materials. Even very small amounts of fuel oil severely reduced the hatchability of the test eggs. Ducklings from the test eggs exhibited no gross external malfunctions or behavioral abnormalities but did show some growth inhibition, suggesting sublethal physiological damage or internal abnormalities.

C-1912-77
BIOAVAILABILITY OF SEDIMENT-SORBED NAPHTHALENES TO THE SIPUNCULID WORM, PHASCOLOSOMA AGASSIZII
Anderson, J. W., L. J. Moore, J. W. Blaylock, D. L. Woodruff, and S. L. Kiesser. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 276-285. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Sediment, Uptake, Release, Annelids, *Phascolosoma agassizii, *Naphthalenes

The uptake and release of crude oil naphthalenes by the title organism were compared for exposure to oil in aqueous solution, on the sediment surface, or mixed into the sediment. Significant amounts of naphthalenes were detected in the test organisms after 24 hours. When the worms were removed to clean water or sediments, depuration of the naphthalenes to background levels occurred within two weeks, indicating little bioaccumulation of these hydrocarbons.

C-1913-77
RESPONSES TO SUBLETHAL LEVELS OF PETROLEUM HYDROCARBONS: ARE THEY SENSITIVE INDICATORS AND DO THEY CORRELATE WITH TISSUE CONTAMINATION?
Anderson, J. W. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 95-114. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Toxicity, Hydrocarbons, Marine organisms, Metabolism, Behavior, Analytical techniques, *Sublethal levels

Numerous studies are critically analyzed and summarized regarding the effects of petroleum hydrocarbons on physiological parameters including respiration, ionic and osmotic regulation, behavior, growth, and reproduction in marine organisms. Recommendations are made to assure the validity of experimental approaches and analytical methodology applied in such studies.

C-1914-77
TOXICITY OF CRUDE OILS AND FUEL OILS PRESENTED DIRECTLY TO MICROALGAE
Batterton, J. C., K. Winters, and C. Van Baalen 1977.
Journal of Phycology 13 (Supplement):6. Abstract.

Toxicity, Crude oil, Fuel oil, Algae

Fuel oils were much more growth-inhibiting than crude oils for a green alga, a blue-green alga, and a diatom. "Baton Rouge" and "New Jersey" fuel oil samples were toxic but were detoxified by heating. Chemical data suggest that the less water-soluble compounds in the higher boiling aromatic fraction are the cause of toxicity.

C-1915-77
THE EFFECT OF PETROLEUM HYDROCARBONS ON REPRODUCTION OF AN ESTUARINE PLANKTONIC COPEPOD IN LABORATORY CULTURES
Berdugo, V., R. P. Harris, and S. C. O'Hara. 1977.
Marine Pollution Bulletin 8(6):138-143.

Aromatic hydrocarbons, Crustaceans, Biological effects, Estuaries, *Copepod

The effect of short-term exposure of *Eurytemora affinis* to high hydrocarbon concentrations which might occur immediately under an estuarine oil-slick is studied. Exposure to the water-soluble fraction of aromatic heating oil resulted in various biological effects including a reduced feeding rate and sublethal effects on reproduction during the subsequent life span of the female. Comparisons were drawn of the effects of exposure to naphthalene alone.

C-1916-77
USE OF DISPERSANTS TO CONTROL ACCIDENTAL DISCHARGE OF PETROLEUM PRODUCTS AT SEA. ECOLOGICAL EFFECTS [in French]
Bocard, C., G. C. Gatellier, and P. Renault. 1976.
Rueil Malmaison, France, Institut Francais du Pétrole, 1976.
IFP--24162. 22 p.

Dispersants, Spill cleanup, Oil discharges, Toxicity, Marine organisms

The effects of two classes of oil spill dispersants on hydrocarbons and their toxicity are reviewed. Some recommendations are made for the homologation criteria of dispersants.

[from Aquatic Sciences & Fisheries Abstracts 7(4):#7Q4584. 1977]

C-1917-77
ENVIRONMENTAL EFFECT OF OIL AND THE CHEMICALS USED TO CONTROL IT ON 4) BIRDS
Bourne, W. R. P. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p. 72-82.

Birds, *Seabirds, Oil spills, Biological effects, Restoration

The vulnerability of birds, especially the pelagic seabirds, to oil pollution is particularly great because they encounter oil floating on water and ingest it from oiled feathers. Their mobility, migratory patterns, tendency to congregate to feed, roost, or breed, and their low reproductive capacity increases their vulnerability to oil pollution. Possible means of frightening birds away from areas of pollution, and the rehabilitation of oiled birds are briefly discussed.

C-1918-77
SEABIRDS AND POLLUTION
Bourne, W. R. P. 1976.
Marine Pollution. R. Johnston (ed.). London, Academic Press, 1976. p. 403-502.

Birds, *Seabirds, Biological effects, Oil spills, Oil slicks, Chronic effects

The effects of various pollutants, including oil, on seabirds are detailed. Oil pollution is particularly serious because it causes both physical and chemical damage. Serious oil pollution incidents affecting seabirds are documented, with numerous examples from offshore Europe and the rest of the world. Vulnerability of birds to oil during breeding season, moulting, roosting, and feeding activity is described.

C-1919-77
EFFECTS OF CRUDE OIL ON BACTERIAL AND FUNGAL POPULATIONS IN FRESH WATER ARTIFICIAL PONDS
Breuil, C., and D. B. Shindler. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. Q45. Abstract.

Crude oil, Biological effects, Bacteria, Fungi, Ice, Freshwater, *Oil-under-ice

The effects of winter under-ice crude oil spills on the microbial population of artificial freshwater ponds were monitored for over a year, and seasonal variations in bacterial and fungal populations are reported.

C-1920-77
EFFECTS OF A SEAWATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL AND ITS MAJOR AROMATIC COMPONENTS ON LARVAL STAGES OF THE DUNGENESS CRAB, *CANCER MAGISTER* DANA
Caldwell, R. S., E. M. Caldarone, and M. H. Mallon. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 210-220. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Toxicity, Aromatic hydrocarbons, Crustaceans, *Larval development, **Cancer magister* Dana

Larval stages of *C. magister* Dana were exposed continuously to dilutions of Cook Inlet crude oil water-soluble fraction (WSF) or seawater solutions of naphthalene or benzene for periods up to 60 days. Effects on survival, duration of larval development and size were used as indicators of toxicity. The lowest concentration of WSF at which toxic effects were seen was 4.0% of the full strength WSF (0.0049 mg/L as naphthalene or 0.22 mg/L as total dissolved aromatics). The lowest concentrations at which toxic effects were observed with naphthalene and with benzene were 0.13 mg/L and 1.1 mg/L, respectively. Concentrations of aromatic hydrocarbons in the WSF were inversely related to the degree of alkylation in the benzene and naphthalene families, but acute toxicity was directly related to the degree of alkyl substitution.

C-1921-77
THE EFFECT OF PETROLEUM HYDROCARBONS ON THE SURVIVAL AND LIFE HISTORY OF POLYCHAETOUS ANNELIDS
Carr, R. C., and D. J. Reish. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 168-173. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Fuel oil, Toxicity, Polychaetes, *Reproduction

The toxicity of seawater-soluble fractions of No. 2 fuel oil and South Louisiana crude oil to 5 species of polychaetous annelids was determined. A wide variability in species sensitivity to the 2 oils was observed. The water soluble fractions of No. 2 fuel oil were more toxic to all species than South Louisiana crude oil. The effects of petrochemicals on reproduction were measured and results are discussed.

C-1922-77
ARGO EFFECTS BAD BUT NOT DISASTROUS (news brief)
Cornell, C. 1977.
National Fisherman 58(3):21-A, 26-A.

Argo Merchant spill, Biological effects, Invertebrates, Fish, Food web

Several conclusions based on preliminary data were stated at an EPA-sponsored seminar in Narragansett, Rhode Island, on the aftereffects of the "Argo Merchant" spill. Adult fish and commercial invertebrates seem to have escaped damage, although fish eggs and larvae showed high rates of mortality and abnormality, and the food web is endangered by contaminated plankton and copepods. Long-range effects on the ecosystems of Nantucket Shoals and Georges Bank are still unknown.

C-1923-77
SUBLETHAL POLLUTANT EFFECTS UPON THE NATIVE MICROFLORA OF GEORGIA STRAIT
Dietz, A. S., T. Tuominen, and L. J. Albright. 1976.
Proceedings of the Third International Biodegradation Symposium.

J. M. Sharpley, and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, 1976. p. 1083-1090. Held in Kingston, Rhode Island, 17-23 August, 1975.

Microorganisms, Crude oil, Fuel oil, Biological effects, Canada, *Georgia Strait, *Heterotrophic potential, *Productivity

Glucose heterotrophic potential, bacterial productivity, and primary productivity of the native microflora in Georgia Strait were determined before and after treatment with crude oil, fuel oil, and 5 other pollutants. Crude oil enhanced bacterial productivity, inhibited primary productivity, and decreased heterotrophic potential. Diesel fuel had no effect on these 3 biological paramaters.

[from Pollution Abstracts 8(4):#77-03315. 1977]

C-1924-77

UPTAKE AND CLEARANCE OF PETROLEUM HYDROCARBONS IN THE RINGED SEAL, PHOCA HISPIDA

Engelhardt, F. R., J. R. Geraci, and T. G. Smith, 1977. Journal of the Fisheries Research Board of Canada, 34(8): 1143-1147.

Biological effects, Hydrocarbons, Crude oil, Uptake, Marine mammals, Beaufort Sea, *Ringed seal

The authors assessed the uptake, distribution, and clearance of Norman Wells crude oil in the title species after exposure by immersion and by ingestion of contaminated fish. In this acute study, the seals showed rapid absorption of hydrocarbons into body tissues and fluids. The results suggest that detoxifying and excretory mechanisms function through the liver, bile, and urine, but it is unknown what effects longer exposure with increased accumulation in the body would have.

C-1925-77

EFFECT OF PETROLEUM HYDROCARBONS ON SALT MARSH MICROBIAL COMMUNITIES

Ereditario, J. M., and F. K. Pfaender. 1977. American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. N72. Abstract.

Hydrocarbons, Fuel oil, Biological effects, Microorganisms, Biodegradation, Marshes, *Salt marsh

The effects of motor oil and diesel fuel hydrocarbons on microbial communities were studied in simulated salt marsh ecosystems. Based on plate and epifluorescence counts, total viable organisms initially decreased coincident with a relative increase of hydrocarbon degraders. After 5 days and until the end of the experiment (5 weeks), the total populations gradually increased, coinciding with a stabilizing of the number of oil degraders. Final species diversity index averages were about the same as the control in the ecosystems receiving low hydrocarbon concentrations and slightly lower in those receiving high concentrations.

C-1926-77
CULTURE TECHNIQUES AND REACTIONS OF BRACKISH WATER COPEPODS TO OIL TOXINS
Fain, G. D. 1977.
Dissertation Abstracts International B 37(9):4354-B.

Crude oil, Toxicity, Crustaceans, *Mississippi Sound, *Copepods

Species of 3 pelagic orders of copepods present in the Mississippi Sound were collected for the laboratory study. The oils used in bioassay preparation were Empire Mix, and Iranian, Nigerian, Saudi Arabian, and Venezuelan crude oils. Nigerian crude oil proved to be the most toxic.

[from Petroleum Abstracts 17(27):#235,288. 1977]

C-1927-77
THE SANTA BARBARA OIL SPILL: AN ECOLOGICAL DISASTER?
Foster, M. S., and R. W. Holmes. 1977.
Recovery and Restoration of Damaged Ecosystems. J. Cairns, Jr., K. L. Dickson, and E. E. Herricks (eds.). Charlottesville, University Press of Virginia, 1977. p. 166-190. Proceedings of the International Symposium on the Recovery of Damaged Ecosystems, Blacksburg, Virginia, March 23-25, 1975.

Oil spills, Environmental effects, Marine organisms, Birds, Biological effects, Santa Barbara Channel

The 1969 Santa Barbara oil spill released over 70,000 bbl of crude oil into the Santa Barbara Channel. The greatest known damage occurred in surfgrass communities and barnacle and bird populations. Cleanup procedures resulted in additional damage on rocky shores and sandy beaches. Although some populations have recovered, the lack of prespill and postspill information makes it impossible to determine adequately the long-term effects.

C-1928-77
CYTOLOGICAL DAMAGE IN MERCENARIA MERCENARIA EXPOSED TO PHENOL
Fries, C. R., and M. R. Tripp. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 174-181. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Biological effects, Mollusks, *Phenol, *Cytology, *Mercenaria mercenaria

Gills, gut, digestive gland, and blood cells were damaged when exposed to various concentrations (1 to 50,000 ppb) of phenol. Basophilic tissue staining was evident at lower concentrations; moderate necrosis and sloughing of ciliated epithelial layers were seen at higher concentrations. Blood sinuses were distended and contained precipitated hemolymph. In the gill, only the chitinous supporting rods remained at 50,000 ppb phenol.

C-1929-77

EFFECTS OF TEMPERATURE AND SALINITY OF NAPHTHALENES UPTAKE IN THE TEMPERATURE [sic] CLAM, RANGEA CUNEATA AND THE BOREAL CLAM, PROTOTHACA STAMINEA

Fucik, K. W., and J. W. Neff. 1977.

Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 305-312. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Uptake, Release, Mollusks, *Naphthalenes, *Rangea cuneata, *Protothaca staminea

Representing a temperate and a boreal species, the clams were exposed to a 25% water soluble fraction of Southern Louisiana crude oil for 3 days under varying temperature and salinity conditions, and then allowed to depurate for 3 days under the same conditions. Naphthalene uptake for both clams was greatest at the lowest temperatures; salinity variations had little influence. Tissue naphthalenes concentrations were greater in the temperate clam, R. cuneata, after the same exposure period than in the boreal clam.

C-1930-77

EFFECTS OF VARIOUS LEVELS OF CRUDE OIL ON OLNEY BULRUSH (SCIRPUS OLNEYI) AND MARSHHAY CORDGRASS (SPARTINA PATENS)

Gebhart, J. L., and R. H. Chabreck, 1976.

Proceedings of the Annual Conference Southeastern Association of Game & Fish Commissioners 29:567-577.

Plants, Crude oil, Contamination, Toxicity, *Olney bulrush, *Marshhay cordgrass

The title species were subjected to four concentrations of a light and a heavy crude oil at four water levels over an 8.5 month period. For both plants a fluctuating water level (+5 to -5 cm) at a water level of +5 cm above the soil surface was most detrimental. Results are given comparing the damaging effects of heavy and light oils to growth and survival of these plants.

[from Applied Ecology Abstracts 3(7):#3D8370. 1977]

C-1931-77
A BACTERIOLOGICAL STUDY OF FIN ROT IN MULLET ASSOCIATED WITH EXPOSURE TO CRUDE OIL
Giles, R. C., and L. R. Brown. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. Q43. Abstract.

Crude oil, Biological effects, Fish, *Fin rot, *Mugil cephalus

Fin rot infections resulted in mullet (Mugil cephalus) when they were experimentally exposed to 4.0-5.0 mg/L crude oil concentrations in estuarine ponds. Depending on the crude oil used, about 96-97% of the fish developed the infection as compared to 6-7% in control ponds. This paper reports microbiological aspects of the course of the infection as documented from two months of observation following exposure to the oil.

C-1932-77
UPTAKE PATHWAYS AND ELIMINATION OF A NONIONIC SURFACTANT IN COD (GADUS MORRHUA L.)
Granmo, A., and S. Kollberg. 1976.
Water Research 10(3):189-194.

Dispersants, Biological effects, Surfactants, Fish, Toxicity

The nonionic surfactant nonylphenol ethoxylate, NP 10 EO, which is used in the manufacturing of synthetic washing powders and oil dispersants, was studied at exposure concentrations of 5 ppm. Penetration and uptake take place in tissues and organs of cod. It is suggested that the main cause of acute poisoning is asphyxiation through surfactant accumulation in the gills.

C-1933-77
EFFECTS OF CHLORINATED BIPHENYLS AND PETROLEUM HYDROCARBONS ON THE ACTIVITY OF HEPATIC ARYL HYDROCARBON HYDROXYLASE OF COHO SALMON (ONCHORHYNCHUS KISUTCH) AND CHINOOK SALMON (O. TSHAWYTSCHA)
Gruger, E. H., Jr., M. M. Wekell, and P. A. Robisch. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 323-331. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Fish, Uptake, Release, *Coho and Chinook salmon, *Chlorinated biphenyls, *Enzyme activity

The title organisms were fed mixtures of test compounds, one composed of a mixture of hydrocarbons, the other a mixture of chlorinated biphenyls. The latter was found to interact synergistically with the hydrocarbons, inducing aryl hydrocarbon hydroxylase activity in the hepatic microsomes of coho salmon, but depressing it in the chinook salmon. The presence of chlorobiphenyls thus may interfere with the natural accumulation and discharge of petroleum hydrocarbons in organisms.

C-1934-77

THE EFFECTS OF ESSO COREXIT 9527 ON THE FERTILIZING CAPACITY OF SPERMATOZOA

Hagström, B. E., and S. Lönning 1977.
Marine Pollution Bulletin 8(6):136-138.

Dispersants, Echinoderms, Toxicity, *Esso Corexit 9527, *Fertilization

The present study of the effect on sea urchin spermatozoa indicates that the water-soluble oil dispersant Esso Corexit 9527 interferes with fertilization and development in concentrations down to 0.0003 ppm. It is believed that such concentrations will be achieved after any use of the dispersant at sea. The components of Esso Corexit 9527 have not been published by the manufacturers.

C-1935-77

FACTORS AFFECTING THE RETENTION OF A PETROLEUM HYDROCARBON BY MARINE PLANKTONIC COPEPODS

Harris, R. P., V. Berdugo, E.D.S. Corner, C. C. Kilvington, and S.C.M. O'Hara. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 286-304. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Crustaceans, Plankton, Uptake, Release *^{14}C-1-naphthalene, *Copepods

Radiolabeled ^{14}C-1-naphthalene was used as a model compound to study retention of aromatic hydrocarbons by 7 species of marine planktonic copepods. Naphthalene concentrations in the range of 0.2 to 1000 µg/L were used in order to simulate concentrations likely to exist in oil spill situations. After uptake the animals were transferred to clean water and 34 days later, they still retained an average of 10% of the initially accumulated ^{14}C-1-naphthalene.

C-1936-77

THE EFFECTS OF PETROLEUM HYDROCARBON EXPOSURE ON THE STRUCTURE OF FISH TISSUES

Hawkes, J. W. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 115-128. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Fish, Biological effects, Hydrocarbons, Analytical techniques, *Tissues, *Morphological changes

Literature on the morphological effects of petroleum contamination is reviewed, and new information on cellular and subcellular tissue changes in fish exposed to petroleum is presented. Light microscopy, and transmission and scanning electron microscopy techniques were used to document changes in skin, gills, liver, eye lens, and other organ tissues.

C-1937-77
EFFECTS OF THE CHESAPEAKE BAY OIL SPILL
Hershner, C. H., and K. A. Moore. 1977.
Ecolibrium 6(3):20-21.

Oil spills, Biological effects, Marshes, Marine organisms, Birds, Mollusks, Chesapeake Bay, *Marsh grasses

A study was conducted to determine the biological effects of the February, 1976, Chesapeake Bay oil spill on the marshes of the eastern shore of the Bay. The spill resulted in an unusually high kill of water birds, but the damage to other members of the ecosystem, such as the intertidal mussel, *Modiolus demissus*, the oyster, *Crassostrea virginica*, and the snail, *Littorina irrorata*, was minimal. The marsh grass, *Spartina alterniflora*, showed an increase in net production and flowering success and a decrease in mean height.

C-1938-77
EFFECT OF CRUDE OIL ON TROUT REPRODUCTION
Hodgins, H. O., W. D. Gronlund, J. L. Mighell, J. W. Hawkes, and P. A. Robisch. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 129-137. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Chronic effects, Toxicity, Fish, *Trout reproduction

Prudhoe Bay crude oil was added to the diet (1g oil/kg food) of sexually maturing rainbow trout in order to assess the chronic effects of the oil exposure on salmonid fish reproductive success. Six to seven months after initial treatment, survival and development of hatched eggs, fertility rates, and morphological and histological abnormalities were compared for test fish and their controls. No significant impairment of reproductive success was detected in the experiment.

C-1939-77
ECOLOGICAL RESPONSES OF PHYTOPLANKTON ON CHRONIC OIL POLLUTION
Ignatiades, L., and N. Mimicos 1977.
Environmental Pollution 13(2):109-118.

Contamination, Chronic effects, Phytoplankton, Aegean Sea

The phytoplankton ecology in the chronically oil-polluted Elefsis Bay (Saronicos Gulf, Aegean Sea) inshore environment was studied over an annual cycle. Emphasis was placed on the species composition, dominance, diversity, and succession of diatoms and dinoflagellates, but generally most taxa were tolerant of the oil in concentrations up to 27 mg/L. Results are compared with data on unpolluted environments.

C-1940-77
PETROLEUM, TEMPERATURE, AND TOXICANTS: EXAMPLES OF SUSPECTED RESPONSES BY PLANKTON AND BENTHOS ON THE CONTINENTAL SHELF
Jeffries, H. P., and W. C. Johnson, II. 1976.
Marine Reprint-69, NOAA-77011708; Grant NOAA-04-6-158-44002.
17 p.

Crude oil, Toxicity, Plankton, Benthos, OCS, *New York Bight, New York

Gross population changes enumerated over time in natural communities of the New York Bight are examined. For open coastal areas in the Mid-Atlantic Bight, the direct effect on copepod populations is at present not a concern. Limited, short-term effects are seen only at point discharges. However, on the sea bottom, small-scale environmental changes have cumulative effects that are enhanced in the benthos, rather than dissipated as in the plankton, by ecosystem processes.

C-1941-77
MORTALITY OF MAGELLANIC PENGUINS IN ARGENTINA
Jehl, J. R., Jr. 1975.
Auk 92(3):596-598.

Birds, Contamination, Coasts, Argentina, *Tierra del Fuego, *Penguins, *Mortality

Oiling appears to be an important contributor to the mortality of Magellanic penguins and other birds living along the Tierra del Fuego coast of Argentina. A large number of bird remains have been found on beaches of the area contaminated or completely coated with oil.

[from Ecological Abstracts 1976/6:#76L/4438. 1977]

C-1942-77

ALTERATIONS IN SOME CARBOHYDRATE METABOLISM INDEXES IN BLOOD OF SEA BASS AND BLACK SEA SOLE EXPERIMENTALLY POISONED WITH DISSOLVED PETROLEUM PRODUCTS [English summary]

Kotor, A. M. 1976.
Gidrobiologiya Zhurnal 12(6):84-88.

Petroleum products, Toxicity, Metabolism, Fish, **Spicara smaris*, **Solea lascaris nasuta*.

"Petroleum products at 9.3 mg/L raised the glucose level in the blood of sea bass (*Spicara smaris*) within 72-120 h, whereas at 16.4-22.2 mg/L decreased it within 5-51 h. However, within 4 h, the petroleum products at 22.2 mg/L raised the blood glucose and glycogen and decreased lactic acid. At 0.05 and 0.1 mg/L, the petroleum products decreased glucose and lactic acid, and raised glycogen during 42 days. In the sole (*Solea lascaris nasuta*) 0.05 and 0.1 mg/L of petroleum products raised the blood glucose for 20 days, and glycogen and lactic acid for 10 days."

[from Chemical Abstracts 86(25):#184068h. 1977]

C-1943-77

SEZONNAYA DINAMIKA GEMATOLOGISHESKIKH POKAZATELEI U NEKOTORYKH CHERNOMORSKIKH RYB I IKH IZMENENIE PRI EKSPERIMENTAL' NOM OTRAVLENII NEFTEPRODUKTAMI [in Russian]

Kotov, A. M. 1976.
Gidrobiologicheskii Zhurnal 12(4):63-68.

Petroleum products, Toxicity, Fish, *Hematological changes

The effect of dissolved petroleum products on the blood of the fish, *Spicara smaris*, *Diplodus annularis*, and *Solea lascaris nasuta* was studied. The oil products produced pronounced pathological disturbances of the blood, including leukocytosis which occurred in two of the species. Hematological changes can be used as criteria for estimating the toxic effect of soluble petroleum products in fish.

[from Pollution Abstracts 8(4):#77-03237. 1977]

C-1944-77

LONG-TERM EFFECTS OF AN OIL SPILL ON POPULATIONS OF THE SALT MARSH CRAB *UCA PUGNAX*

Krebs, C. T., and K. A. Burns. 1977.
Science 197(4302):484-487.

Fuel oil, Oil spills, Contamination, Marshes, Crustaceans, Biological effects, Massachusetts, **Uca pugnax*

A fuel oil spill at West Falmouth, Massachusetts, in 1969, contaminated salt marshes with up to 6000 ppm oil per gram of mud, and adversely affected local populations of the fiddler crab, Uca pugnax. The oil pollution resulted in reduced crab density, reduced ratio of females to males, reduced juvenile settlement, heavy overwintering mortality, incorporation of oil in body tissues, and behavioral disorders in locomotion and abnormal burrow construction. As yet, recovery of the marsh from this relatively small spill is incomplete.

C-1945-77
INTERACTIVE EFFECTS OF TEMPERATURE, SALINITY SHOCK AND CHRONIC EXPOSURE TO NO. 2 FUEL OIL ON SURVIVAL, DEVELOPMENT RATE AND RESPIRATION OF THE HORSESHOE CRAB, LIMULUS POLYPHEMUS
Laughlin, R. B., Jr., and J. M. Neff. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 182-191. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Fuel oil, Biological effects, Metabolism, Crustaceans, *Temperature, *Salinity, *Limulus polyphemus

Survival of larvae decreased with decreasing temperature and increasing concentrations of water-soluble fractions (WSF) of No. 2 fuel oil. The respiration rates of control animals decreased with decreasing salinity and temperature. The respiration rate of oil-exposed crabs was significantly higher than that of controls at nearly all salinity/temperature combinations. The interaction of salinity and WSF exposure on respiratory rate was highly significant.

C-1946-77
DEVELOPMENT OF AN INVERTEBRATE BIOASSAY TO SCREEN PETROLEUM REFINERY EFFLUENTS DISCHARGED INTO FRESHWATER
Lee, D. R. 1976.
Ph.D. Thesis, Virginia Polytechnic Institute, Blacksburg, Virginia. 118 p.

Refineries, Toxicity, Wastewaters, Freshwater, Monitoring, Invertebrates, *Daphnia pulex, *Bioassay

A simple method which uses unsophisticated equipment has been developed for on-site toxicity testing of refinery effluents. The method uses Daphnia pulex bioassays because the organism is the most sensitive of 15 species of freshwater invertebrates and 3 fish species tested, and because it is inexpensive and easy to maintain. Daphnia bioassays were field tested at several refineries. The test results are in agreement, reproducible, and can be performed readily by refinery personnel.

[from Dissertation Abstracts International B 37(4):1551-1552. 1976]

C-1947-77

ACCUMULATION AND TURNOVER OF PETROLEUM HYDROCARBONS IN MARINE ORGANISMS

Lee, R. F. 1977.

Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 60-70. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Uptake, Storage, Release, Marine organisms

This review deals with the uptake, storage, and discharge of petroleum hydrocarbons by marine organisms under laboratory and field conditions. Under the heading, "Bioaccumulation," analyses of organisms collected from oil spill and chronically polluted areas are reviewed. The section entitled, "Biological Transfer Processes," discusses the ability of animals to depurate their hydrocarbons accumulated after exposure to oil.

C-1948-77

TOXICITY EFFECTS OF A CRUDE OIL ON THE PRIMARY PRODUCTION OF THE PHYTOPLANKTON OF THE RANCE ESTUARY: INFLUENCE OF TEMPERATURE AND CONTACT TIME [English summary]

Le Pemp, X., J.-C. Lacaze, and O. Villedon de Naïde. 1976.

Bulletin du Museum National d'Histoire Naturelle, Paris (3e Sér.), Ecologie generale 386(32):107-110.

Toxicity, Crude oil, Phytoplankton, Estuaries, *Kuwait crude

Experiments showed that the toxicity of Kuwait crude oil rises with temperature in the case of a biocenose-extract contact time of 24 hours. However, the temperature dependence is eliminated and the toxicity is reduced to one-seventh when the exposure time is reduced to four hours.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10523. 1977]

C-1949-77

CHRONIC TOXICITY OF A SYNTHETIC TRI-ARYL PHOSPHATE OIL TO FISH

Lockhart, W. L., R. Wagemann, J. W. Clayton, B. Graham, and D. Murray, 1975.

Environmental Physiology and Biochemistry 5(6):361-369.

Toxicity, Chronic effects, Fish, Freshwater, Lubricating oil, *Synthetic oil

A long-term, continuous-flow exposure of rainbow trout (Salmo gairdneri) to IMOL S-140, a synthetic high-temperature lubricating oil, was conducted after concern was raised over past and future dangers of oil losses from natural gas pipeline pumping stations. No sign of acute toxicity was observed, but the fish slowly developed symptoms of chronic poisoning. The toxicity was not revealed by standard 96-hr bioassay methods nor by serum and brain cholinesterase measurements.

C-1950-77
RECOLONIZATION OF RED SEA CORALS AFFECTED BY NATURAL CATASTROPHIES AND MAN-MADE PERTURBATIONS
Loya, Y. 1976.
Ecology 57(2):278-289.

Coral reefs, Biological effects, Contamination,Red Sea, Israel, *Succession, *Recolonization

This paper studies the recovery patterns of hermatypic coral communities following a catastrophic low tide, observing two reef flats in the northern Gulf of Eilat. The control reef was pollution-free, but the other, at the nature reserve of Eilat, Israel, neighbors the port of Eilat and two major oil terminals and is thus chronically polluted. The conclusion is made that the man-polluted coral reef will not return to its former equilibrium, but the naturally disturbed community will recover over time.

C-1951-77
EFFECTS OF PETROLEUM ON ARCTIC AND SUBARCTIC MARINE ENVIRONMENTS AND ORGANISMS
Malins, D. C. 1977.
New York, Academic Press, 1977. Vol. II. Biological Effects of Petroleum.

Hydrocarbons, Biological effects, Marine organisms, Ecosystems, Arctic, Subarctic regions

The impacts of petroleum hydrocarbons on the biota of pristine areas are poorly understood, despite certain relevant data from laboratory experiments with indigenous organisms and a lesser amount of field information. In this volume an attempt is made to compile data on the biological effects of petroleum on marine organisms, evaluate the implications to possible alterations in organisms and ecosystems, and offer suggestions for future work where significant gaps in knowledge exist.

C-1952-77
THE EFFECTS OF AN OIL SPILL ON THE MACROINVERTEBRATES AND FISH IN A SMALL SOUTHWESTERN VIRGINIA CREEK.
Masnik, M. T., J. R. Stauffer, C. H. Hocutt, and J. H. Wilson. 1976.
Journal of Environmental Science and Health A11 (4 & 5):281-296.

Oil spills, Fuel oil, Biological effects, Invertebrates, Fish, Streams, Virginia

Approximately 13,000 L of No. 2 fuel oil entered Plum Creek in May, 1973, after the tank of a disabled tractor trailer truck overturned. Immediate mortality of water snakes and waterfowl was high, but collections of benthos and fishes over a five-month period indicated minimal mortality and only slight reductions in population levels. It was recommended that the use of straw booms be reevaluated, as leaching of oil fractions from the straw over time may result in chronic environmental damage.

C-1953-77
MOLTING AND SURVIVAL OF KING CRAB (PARALITHODES CAMTSCHATICA) AND COONSTRIPE SHRIMP (PANDALUS HYPSINOTUS) LARVAE EXPOSED TO COOK INLET CRUDE OIL WATER-SOLUBLE FRACTION
Mecklenburg, T. A., S. D. Rice, and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 221-228. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Biological effects, Crustaceans, *Water-soluble fraction, *Molting larvae

Molting larvae were more sensitive than intermolt larvae to the water-soluble fraction (WSF) of crude oil, and molting coonstripe shrimp larvae were more sensitive than molting king crab larvae. When molting larvae were exposed to high concentrations of the WSF (1.15-1.87 ppm total hydrocarbons) for six hours, molting success was reduced by 10-30% and some deaths occurred. When larvae were exposed to these concentrations for 24 hours or longer, molting declined 90-100% and the larvae usually died. Comparisons of sensitivity to oil between different crustacean species or life stages should be based on animals tested in the same stage of the molt cycle.

C-1954-77
THE OCCURRENCE OF FIN ROT IN MULLET (MUGIL CEPHALUS) ASSOCIATED WITH CRUDE OIL CONTAMINATION OF AN ESTUARINE POND-ECOSYSTEM
Minchew, C. D., and J. D. Yarbrough, 1977.
Journal of Fish Biology 10(4):319-323.

Fish, Contamination, Crude oil, Estuaries, *Fin rot, *Mullet

Four ponds were constructed with tidal simulation and stocked with mullet, shrimp, and oysters. A six-month study established a low incidence of disease in the fish. Within one week after Empire Mix crude oil was spilled in two ponds all of the mullet developed fin rot. This disease did not occur in any preliminary laboratory tests of acute exposure of mullet to crude oil.

C-1955-77
TOXIC INFLUENCE OF MINERAL OILS AND GASOLINE ON SELF PURIFICATION PROCESSES IN NATURAL WATERS [English summary]
Mueller, D., and H. Hellmann. 1976.
Gas-Wasserfach, Wasser-Abwasser 117(8):369-373.

Crude oil, Petroleum products, Gasoline, Biodegradation, Toxicity, Bacteria, Algae, Freshwater, *Photosynthesis

Samples of crude oil, diesel fuel, motor oil, and gasoline were added to 10-L volumes of tap water exposed to sun and wind; bacterial biodegradation and algal photosynthesis were monitored for 21 days. Gasoline showed initial strong toxicity followed by increased bacterial activity. Water soluble components of diesel and motor oils increased biodegradation and inhibited photosynthesis. Toxic effects of light and medium crudes paralleled those of gasoline.

[from Chemical Abstracts 87(2):#11356t. 1977]

C-1956-77
EFFECTS OF PETROLEUM ON THE LITTORAL ECOSYSTEM [in Norwegian]
Notini, M. 1976.
NORDFORSK, Miljoevardssekretariatet Publikation (2, Organiska Miljoegifter i Vatten, Nordiska Symposiet om Vattenforskning, 12th):299-316.

Intertidal zone, Biological effects, Spill cleanup, Baltic Sea

This review covers sources of oil pollution in the Baltic Sea, special problems in the littoral zone, and techniques for studying the biological effects of oils and cleanup activities on littoral organisms. Twelve references are cited.

[from Chemical Abstracts 87(8):#57795p. 1977]

C-1957-77
EFFECTS OF OIL ON MICROBIAL COMPONENT OF AN INTERTIDAL SILT-SEDIMENT ECOSYSTEM
Norrell, S. A. and M. H. Johnston. 1976.
Occasional Publications, University of Alaska, Institute of Marine Science 4(Assessment of the Arctic Marine Environment, Selected Topics, Symposium):305-327.

Biological effects, Bacteria, Biomass, Sediments, Microorganisms, Intertidal zone

"A review with twenty-seven references of the relations between bacterial biomass and sediment properties and the effects of oil contamination on microbial growth."

[from Chemical Abstracts 87(7):#49854s. 1977]

C-1958-77

SOME PRELIMINARY OBSERVATIONS ON THE ENHANCEMENT OF PHYTOPLANKTON GROWTH BY LOW LEVELS OF MINERAL HYDROCARBONS

Parsons, T. R., Li, W. K. W., and R. Waters. 1976.
Hydrobiologia 5(1):85-89.

Phytoplankton, Hydrocarbons, Biological effects, Metabolism, *Plant growth, *Photosynthesis

From field and laboratory experiments it has been observed that low concentrations (ppb) of mineral hydrocarbons can cause an increase in photosynthesis among nanoplankton. It is believed that very low level effects of hydrocarbons on marine phytoplankton may be ecologically important in stimulating the growth of certain nanoplanktonic organisms, causing them to grow faster at the expense of larger phytoplankters.

[from Government Reports Announcements 77(11):#PB-264 727/9GA. 1977]

C-1959-77

MIXED FUNCTION OXIDASES IN MARINE ORGANISMS IN RELATION TO PETROLEUM HYDROCARBON METABOLISM AND DETECTION

Payne, J. F. 1977.
Marine Pollution Bulletin 8(5):112-116.

Hydrocarbons, Metabolism, Detection, Monitoring, Marine organisms, *Enzyme activity, Canada

Several organisms were collected from pollution-free sites in eastern coastal Newfoundland and investigated for mixed function oxidases. AHH activity was detected in some of the phyla, as well as petroleum induced AHH. Only AHH appeared to be a useful enzyme monitor for petroleum, but no invertebrate was considered a useful monitor for petroleum pollution.

C-1960-77

EFFECTS OF DISPERSED CRUDE OIL UPON THE RESPIRATORY METABOLISM OF AN ARCTIC MARINE AMPHIPOD, *ONISIMUS* (*BOEKISIMUS*) *AFFINIS*

Percy, J. A. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 192-200. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Dispersions, Biological effects, Metabolism, Crustaceans, *Sublethal effects, *Arctic amphipod

At low oil concentrations, metabolism is significantly depressed, but with increasing concentration a reversal of the response occurs. An explanation for this response is presented. The effects of oil type, presence of dispersants, nutritional state of the animals, and weathering of the oil on the metabolic response are also considered.

C-1961-77
POLLUTION OF MARINE WATERS
Peres, J. M. 1976.
Paris, France, Bordas, 1976. 231 p.

Pollution control, Biological effects, Benthos, Coasts, *Pelagic organisms

This book brings together several papers on the main problems of marine pollution. Oil pollution control and biological effects of oil contamination are reviewed along with other forms of pollutants. The authors discuss the biological effects on pelagic and benthic communities and on the sea's resources.

[from Aquatic Sciences & Fisheries Abstracts 7(7):#7Q8933. 1977]

C-1962-77
ACUTE TOXICITY AND UPTAKE-DEPURATION STUDIES WITH COOK INLET CRUDE OIL, PRUDHOE BAY CRUDE OIL, NO. 2 FUEL OIL AND SEVERAL SUBARCTIC MARINE ORGANISMS
Rice, S. D., J. W. Short, C. C. Brodersen, T. A. Mecklenburg, D. A. Moles, C. J. Misch, D. L. Cheatham, and J. F. Karinen. 1976.
Northwest Fisheries Center Auke Bay Fisheries Laboratory, Processed report. 90 p.

Crude oil, Fuel oil, Toxicity, Uptake, Release, Marine organisms

This report provides the results of a laboratory study of which the primary objectives were: to determine the acute toxicity of Cook Inlet and Prudhoe Bay crude oils and fuel oil to various life stages and species of fish and shellfish found in Kachemak Bay; to determine the rate and degree of uptake and depuration of hydrocarbons by these organisms when they are exposed to sublethal concentrations of the water-soluble fractions of Cook Inlet crude oil; and to compare results with the published literature in order to determine to what degree Alaskan fish and shellfish differ from species in other areas in their response to oil contamination.

C-1963-77
EFFECT OF PETROLEUM HYDROCARBONS ON BREATHING AND COUGHING RATES AND HYDROCARBON UPTAKE-DEPURATION IN PINK SALMON FRY
Rice, S. D., R. E. Thomas, and J. W. Short. 1977.
Physiological Responses of Marine Biota to Pollutants. New York, Academic Press, 1977.

Crude oil, Fuel oil, Toxicity, Hydrocarbons, Metabolism, Fish, *Respiration, *Oncorhynchus gorbuscha

Breathing and coughing rates of pink salmon fry, Oncorhynchus gorbuscha, were monitored during exposure to water soluble fractions of Cook Inlet and Prudhoe Bay crude oils and No. 2 fuel oil. High breathing rates during the first 24 hr of exposure, elimination of most aromatics by 20 hr , and the continued high breathing during a contact dose exposure for 72 hrs indicate that salmon fry can cope with a sublethal exposure to hydrocarbons, but at the cost of an increased metabolic rate. Increased metabolic rates may be detrimental to survival if the stress persists for long periods of time.

C-1964-77

A REVIEW OF COMPARATIVE OIL TOXICITY AND COMPARATIVE ANIMAL SENSITIVITY

Rice, S. D., J. W. Short, and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 78-94. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Toxicity, Marine organisms, Crude oil, Petroleum products, *Comparative toxicity, *Bioassay

This review includes studies dealing with the ability of crude and refined oils to kill marine animals and covers: (1) the behavior of oil in water; (2) the methodology problems associated with bioassays; (3) the comparative toxicity of oil-water mixtures, oils, and components of oils; and (4) the comparative sensitivity of different life stages and species.

C-1965-77

MUSSELS AND POLLUTION

Roberts, D. 1976.
Marine Mussels: Their Ecology and Physiology. B. L. Bayne (ed.). Cambridge University Press, 1976. p.67-80.

Hydrocarbons, Crude oil, Toxicity, Mollusks, Bibliographies, Surfactants, Emulsifiers, *Mussels

This chapter briefly reviews the literature concerning the effects of pollutants on mussels. Seventeen references are cited concerning oil and detergent pollution, dated from 1961 to 1974. The research covers hydrocarbons, crude oil, detergents and oil emulsifiers, and toxicity.

C-1966-77
RESPONSES TO CRUDE OIL CONTAMINATION BY CRICOTOPUS (CRICOTOPUS) BICINCTUS AND C. (C.) MACKENZIENSIS (DIPTERA: CHIRONOMIDAE) IN THE FORT SIMPSON AREA, NORTHWEST TERRITORIES
Rosenberg, D. M., A. P. Wiens, and O. A. Saether. 1977.
Journal of the Fisheries Research Board of Canada 34(2):254-261.

Crude oil, Biological effects *Insects, Canada, *Chironomid larvae

The two title species of Chironomidae, common to the Fort Simpson area, were examined for changes resulting from experimental exposure to crude oil. Larvae of both species were more abundant on oiled artificial substrates; larvae of C. (C.) bicinctus tended to dominate. Larvae on oiled substrates appeared to have more rapid life cycles and produced part of another generation per year as compared to larvae on unoiled substrates.

C-1967-77
PLANKTON PROCESSES IN MID-ATLANTIC NEARSHORE AND SHELF WATERS AND ENERGY-RELATED ACTIVITIES
Smayda, T. J. 1975.
Conference on Effects of Energy-related Activities on the Atlantic Continental Shelf, Upton, New York, 1975.

Oil discharges, Hydrocarbons, Contamination, Phytoplankton, OCS, Atlantic coast

The potential effects of temperature and petroleum hydrocarbons on key plankton processes and events are considered, based on phytoplankton physiology. Oil release is a likely source of contamination on the continental shelf; however, shore-based activities of the petrochemical industry and discharges from tankers in shipping lanes and ports may also stress recipient waters.

[from ERDA Energy Research Abstracts 2(12):#30851. 1977]

C-1968-77
THE ACCUMULATION AND DEPURATION OF NO. 2 FUEL OIL BY THE SOFT SHELL CLAM MYA ARENARIA L.
Stainken, D. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 313-322. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Fuel oil, Emulsions, Mollusks, Uptake, Release, *Mya arenaria L.

The title organisms were exposed experimentally to No. 2 fuel oil-in-water emulsions at 4°C to simulate winter spill conditions, and the patterns of accumulation and discharge of petroleum constituents were determined. The clams can rapidly accumulate, concentrate, and release to the environment large amounts of petroleum hydrocarbons by means of a reversible mucus-oil binding mechanism.

C-1969-77
EFFECTS OF CERTAIN PETROLEUM PRODUCTS ON REPRODUCTION AND GROWTH OF ZYGOTES AND JUVENILE STAGES OF THE ALGA FUCUS EDENDATUS DE LA PYL (PHAEOPHYCEAE: FUCALES)
Steele, R. L. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 138-142. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Petroleum products, Fuels, Crude oil, Biological effects, Algae, *Growth, *Reproduction, *Fucus edentatus De La Pyl

The effects of various petroleum products on growth and the early development of the Fucus zygote were studied experimentally. A crude oil had far less of an effect on Fucus growth than did No. 2 fuel oil or two jet fuels. Exposure to any of the oil products immediately prior to or during the release of gametes completely prevented germination or growth.

C-1970-77
SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION
Steele, R. L., 1977.
Journal of Phycology 13 (Supplement):64. Abstract.

Toxicity, Algae, *Reproduction, Contamination

The author studied two genera of brown algae, Fucus and Laminaria, to measure oil pollution toxicity in these bioassay organisms. Four kinds of oil were tested and both algae were found to be sensitive at less than 100 ppb. Male reproductive cells were much more sensitive than eggs or female gametophytes.

C-1971-77
BIOLOGICAL SURVEY OF INTERTIDAL AREAS IN THE STRAITS OF MAGELLAN IN JANUARY, 1975, FIVE MONTHS AFTER THE METULA OIL SPILL
Straughan, D. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 247-260. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Metula spill, Biological effects, Marine organisms, Intertidal zone, Strait of Magellan

Biological, physical, and chemical data were analyzed, using techniques of ordination, classification, and discrimation, and results indicate a negative relationship between the biota and presence of petroleum. While grain size was important in governing the distribution and abundance of species at the oiled and unoiled sites, the visible presence of petroleum in the form of mousse was the most significant factor.

C-1972-77

EFFECTS OF BENZENE (A TOXIC COMPONENT OF PETROLEUM) ON SPAWNING PACIFIC HERRING, CLUPEA HARENGUS PALLASI

Struhsaker, J. W. 1977.
Fishery Bulletin 75(1):43-50.

Toxicity, Hydrocarbons, Fish, *Benzene, *Reproduction, *Clupea harengus pallasi

Exposure of female Pacific herring to low (ppb) levels of benzene for 48 hr prior to their spawning resulted in a significant reduction in survival of ovarian eggs, embryos, and larvae due to yolk absorption. Exposure to benzene also induced premature spawning and resulted in aberrant swimming behavior and disequilibrium in adults of both sexes.

[from Selected Water Resources Abstracts 10(15):#W77-07137. 1977]

C-1973-77

EFFECTS OF EXTERNAL APPLICATIONS OF NO. 2 FUEL OIL ON COMMON EIDER EGGS

Szaro, R. C., and P. H. Albers. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 164-167. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Fuel oil, Birds, Biological effects, *Hatchability, *Common eider eggs

Eggs of the Common Eider (Somateria mollissima) were coated with up to 20 μl of No. 2 fuel oil and artificially incubated with other treated eggs and controls. Eggs treated with 5 μl and 20 μl fuel oil had hatching rates of 92% and 69%, respectively, as compared to 96% for the control group. Thus, oil pollution may significantly increase embryonic mortality in marine birds.

C-1974-77
ACCUMULATION OF NAPHTHALENES BY GRASS SHRIMP: EFFECTS ON RESPIRATION, HATCHING, AND LARVAL GROWTH
Tatem, H. E. 1977.
Fate and Effects of Petroleum Hydrocarbons on Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 201-209. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Fuel oil, Uptake, Crustaceans, Metabolism, *Naphthalenes, *Hatching, *Larval growth, *Grass shrimp

When *P. pugio* was exposed to petroleum hydrocarbons (PH) from a No. 2 fuel oil, sampling revealed that naphthalene levels in the exposure solution decreased rapidly while concentrations in the shrimp increased dramatically. Exposure of the shrimp to over 3.0 ppm PH for 5 hr resulted in a lower than average respiration rate. A single 72-hr exposure of gravid female shrimp to 1.44 ppm PH had a detrimental effect on larval hatching. Control females released an average of 45 larvae compared to 9 larvae for exposed females. Larvae continuously exposed to 0.85-0.52 ppm PH weighed significantly less than control animals after 12 days.

C-1975-77
RESPONSE OF THE CLAM, *MACOMA BALTHICA* (LINNAEUS), EXPOSED TO PRUDHOE BAY CRUDE OIL AS UNMIXED OIL, WATER-SOLUBLE FRACTION, AND OIL-CONTAMINATED SEDIMENT IN THE LABORATORY
Taylor, T. L., and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 229-237. Proceddings of a Symposium, Seattle, Washington, November 10-12, 1976.

Crude oil, Seawater, Sediments, Biological effects, Mollusks, *Water-soluble fraction, *Oil-treated sediment, **Macoma balthica*

Gentle settling of crude oil over clam beds had negligible effects on clams observed for two months. Water-soluble (WSF) and oil-treated (OTF) sediment fractions of Prudhoe Bay crude oil inhibited burrowing and caused clams to move to the sediment surface. Responses were directly proportional to the concentrations of the WSF or amount of OTF. The significance of these laboratory tests to survival of *M. balthica* in the natural environment is discussed.

C-1976-77
FOOD CHAIN TRANSFER OF HYDROCARBONS
Teal, J. M. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 71-77. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Uptake, Release, Food web, Oceans, *Food chain transfer

The following subjects are covered in this review: selective accumulation of hydrocarbons; hydrocarbon uptake from food vs. water; hydrocarbon storage and depuration; oceanic food web transfer; and related research needs.

C-1977-77
LONG TERM BIOLOGICAL EFFECTS OF BUNKER C OIL IN THE INTERTIDAL ZONE
Thomas, M. L. H. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 238-245. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Marine organisms, Intertidal zone, Chedabucto Bay, Canada, Oil spills, Toxicity, *Mortalities

In February, 1970, a large spill of Bunker C oil occurred in Chedabucto Bay, Nova Scotia, when the tanker "Arrow" grounded. The major species that suffered mortalities in the communities on this shoreline as a result of this spill were studied. Results are summarized.

C-1978-77
FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS - III. EFFECTS OF OIL-SPILL EMULSIFIERS AND SURFACTANTS ON THE GROWTH OF PORPHYRA-LAVER. [English summary]
Tokuda, H. 1977.
Bulletin of the Japanese Society of Scientific Fisheries 43(5): 587-593.

Toxicity, Surfactants, Emulsifiers, Algae, *Seaweed, *Growth rates

Culture experiments were done to determine the inhibitory effects of six oil-spill emulsifiers and four non-ionic surfactants on the growth of Porphyra yezoensis. Growth rates were studied in assessing the toxicity, and changes in the cellular appearance of the laver were also studied by optical microscopy.

C-1979-77
INGESTION OF SUSPENDED OIL PARTICLES AND THE INFLUENCES ON MORTALITY IN THE MOLLUSCAN LARVAE [in Japanese]
Umezawa, S., O. Fukuhara, and S. Sakaguchi. 1976.
Bulletin of the Nansei Regional Fisheries Laboratory, Vol. 9: 77-82.

Toxicity, Mollusks, Uptake, Release, *Oil droplets, *Mortality, *Crassostrea gigas, *Mytilus spp.

Oyster and mussel larvae, Crassostrea gigas and Mytilus spp., respectively, were kept in seawater to which different concentrations of oil droplets were added. The ingestion of the suspended oil droplets and their influences on mortality in these molluskan larvae were investigated. The percentage of the larvae with ingested oil droplets and the diameter of the oil droplets in the stomach of each larvae became greater as the oil droplet concentration in the medium increased. This increase led to an increased mortality rate among the experimental larvae. Molluskan larvae were unable to exude oil droplets ingested in their stomachs; subsequent cohesion of the droplets was the main cause of larvae mortality.

[from Selected Water Resources Abstracts 10(12):#W77-05909. 1977]

C-1980-77
THE EFFECT OF PRUDHOE CRUDE OIL ON PRIMARY PRODUCTION IN ARCTIC PONDS
Vestal, J. R., T. W. Federle, G. R. Hater, and M. C. Miller. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. Q44. Abstract.

Crude oil, Toxicity, Phytoplankton, Arctic, Freshwater, *Primary production

In controlled pond experiments, soluble components of crude oil were found to curtail or completely inhibit primary production of phytoplankton within a few days. As the toxic components of oil were subsequently lost, the primary production slowly recovered, but with a significant shift in the species dominance from Chryptophytes to Chrysophytes.

C-1981-77
ROLE OF MUSSELS MYTILUS EDULIS IN REMOVAL OF PETROLEUM PRODUCTS FROM SEAWATER (UNDER EXPERIMENTAL CONDITIONS)
Vokyo, Y. V., and Y. M. Petrov. 1975.
Hydrobiological Journal 11(2):19-24.

Uptake, Petroleum products, Mollusks, Seawater, *Water purification, *Mytilus edulis

In tanks with mussels, the water was purified twice as fast as in the control. After 3 weeks, only 7% of the initial amount of petroleum remained in the tanks with mussels. Of this amount, about 1.4% was depostied by the aquatic organisms on the tank bottoms, 5.6% remained in the surface film, and 0.2% was still dissolved.

[from Selected Water Resources Abstracts 10(15):#W77-07116. 1977]

C-1982-77
BIOLOGICAL EFFECTS OF OIL CONTAMINATION ON THE SEA WITH SPECIAL CONSIDERATION TO THE BALTIC SEA
Von Oertzen, J. A. 1977.
Wasserwirtschaff - Wassertechnik 27(2):34-37.

Contamination, Biological effects, Baltic Sea

"A review with 37 references."

[from Chemical Abstracts 87(1):#726n. 1977]

C-1983-77
EFFECTS OF OIL DISPERSANTS ON THE DEVELOPING EMBRYOS OF MARINE FISH.
Wilson, K. W. 1976.
Marine Biology 36(3):259-268.

Dispersants, Biological effects, Fish, Spill cleanup, *Embryo development

This paper details the effects of three oil dispersants, B1002, Finasol ESK, and Corexit 7664, on the development of plaice, sole, and herring. Concentrations of dispersants and exposure length leading to deleterious effects have been defined, but it is unknown if similar conditions would occur at sea after spill cleanup operations. It is also speculated that use of recently developed dispersants with lower toxicity claims would not produce significant mortality in fish embryos.

C-1984-77
GONADAL AND HEMATOPOIETIC NEOPLASMS IN *MYA ARENARIA*
Yevich, P. P., and C. A. Barszcz. 1976.
Marine Fisheries Review 38(10):42-43.

Oil spills, Biological effects, Mollusks, Maine, *Gonadal neoplasms, **Mya arenaria*

"Microscopic examinations of clams collected from Long Cove, Maine, where there was an oil spill in 1971, revealed gonadal neoplasms in males and females. In other clams neoplastic growth was observed in cells that appeared to be of hematopoietic lineage. Extensive accumulations of neoplastic cells were observed in the gills, siphon, foot, and connective tissues."

[from ERDA Energy Research Abstracts 2(14):#36211. 1977]

2. PHYSICAL EFFECTS

C-1985-77
AN ASPECT OF COASTAL POLLUTION - THE COMBINED EFFECT OF DETERGENT AND OIL AT SEA ON SEA SPRAY COMPOSITION
Fontana, M. 1976.
Water, Air & Soil Pollution 5(3):269-280.

Oil slicks, *Detergents, Physical effects, Seawater, *Sea spray formation

The natural formation of sea spray droplets was simulated under laboratory conditions in order to study the interaction of anionic detergents and oil slicks. Presence of detergents increased the production of sea spray, and the presence of a 1 mm oil slick inhibited the formation of marine aerosols.

[from Chemical Abstracts 86(26):#194756v. 1977]

C-1986-77
THERMAL CONDUCTANCE OF IMMERSED PINNIPED AND SEA OTTER PELTS BEFORE AND AFTER OILING WITH PRUDHOE BAY CRUDE
Kooyman, G. L., R. W. Davis, and M. A. Castellini. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.151-157. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Marine mammals, Biological effects, Crude oil, *Thermal conductance, *Sea otters, *Pinnipeds

Thermal conductance (C) of the sea otter and several species of pinnipeds was measured during immersion, after oiling, and after cleaning. Sea otter pups were found to have the greatest C after oiling; adult pinnipeds were only slightly affected by oiling. Even a light oiling would have significant detrimental effects on the thermoregulatory abilities of otters and fur seals at sea.

3. ECONOMIC EFFECTS

C-1987-77
ANTIPOLLUTION COSTS TO SOAR (news brief)
Anon. 1977.
Ecolibrium 6(2):19.

Regulations, Oil industry, Pollution control, Wastewater treatment, Refineries, Cost analysis, API

An API-sponsored study of the cost to the oil industry of complying with expected environmental regulations has been conducted by the

Battelle Laboratories, Columbus, Ohio. Total costs to industry are expected to be in the range of $10 billion and $17 billion per year. Of this amount, a major expenditure will be for the treatment of refinery wastewaters and rainfall effluent, and for the removal of sulfur and lead from petroleum products.

C-1988-77
OIL SPILL SUPERFUNDS SEEM UNNECESSARY (news brief)
Anon. 1977.
Oil and Gas Journal 75(24):28-29.

Legislation, Liability, Compensation, Tankers, Oil spills, Oil industry, *Spill superfunds

Representatives from two international voluntary oil spill funds, Tovalop and Cristal, feel that the proposed $200 million superfunds to compensate for offshore oil spill damages are far larger than necessary. In contrast, U.S. oil industry officials argue that the existing patchwork of state and federal funds and laws is inadequate and should be replaced by a comprehensive and uniform system.

C-1989-77
REGS [sic] SET FOR TAPS SPILL FUND (news brief)
Anon. 1977.
Oil and Gas Journal 77(27):46.

Oil spills, Liability, Regulations, Tankers, Oil transfer, Ports, Alaska, *Oil spill fund

Regulations providing for the supervision and administration of a $100 million oil spill liability fund have been finalized. The fund will pay damages from oil spills occurring during oil transfer operations at the Alaskan Port of Valdez and at any point enroute between Valdez and the unloading point in a U.S. port.

C-1990-77
WHAT REFINERY POLLUTION ABATEMENT COSTS
Jenkins, D. M., and W. J. Sheppard. 1977.
Hydrocarbon Processing 56(5):154-157.

Regulations, Oil industry, Pollution control, Economic effects, Cost analysis, API, EPA

In this API report, attempts are made to compare and reconcile differences between previous studies of the economic impact of environmental regulations on the petroleum industry. Differences in the cost estimates made by EPA and those made by API are attributed to the methodology used, involving philosophical and regulation selection differences.

C-1991-77
THE HIGH COST OF AN OIL SPILL
White, J. 1977.
Outdoor California 38(2):15.

Oil spills, Inland, Economics, Spill cleanup, Restoration, California

The high cost and difficulty of cleaning up a small inland spill is briefly documented. The spill, which lost about 14,383 L (3800 gal) of heavy fuel oil, occurred near Gilroy, California. Cleanup and restoration took 20 men 17 days. The oil had a value of about $600 before the spill, but its cleaning cost exceeded $50,000.

4. GENERAL EFFECTS

C-1992-77
CANADA'S TANKER LAWS ARE THE TOUGHEST
Anon. 1977.
Canadian Shipping and Marine Engineering 48(6):20-21.

Tankers, Oil spills, Legislation, Economic effects, Environmental effects, Canada

Tanker disasters that have occurred off the Canadian coasts are discussed. The legal, political, economic and environmental issues surrounding such events are examined.

[from Aquatic Sciences & Fisheries Abstracts 7(8):#7Q10421.1977]

C-1993-77
PERSISTING OIL SPILL EFFECTS
Anon. 1977.
Mechanical Engineering 99(January):62-63.

Metula spill, Environmental effects, Beaches, Sediments, Strait of Magellan

A recent visit to the area of the 1974 "Metula" supertanker oil spill in the Strait of Magellan shows that the effects of the spill are still dramatically evident on the beaches. Stranded oil has penetrated nearly 20 cm into sand, producing pavement-like surfaces on the beaches. In areas where the beach surface has eroded, soft, fresh oil is evident in the subjacent layers.

C-1994-77
OIL SPILLS - AN EDITORIAL
Abelson, P. H. 1977.
Ecolibrium 6(2):15.

Oil spills, Tankers, Environmental effects

Recent tanker spills have resulted in the loss of over 56 million L (15 million gal) of oil into the oceans. The general view is that there are ecological catastrophes which will have serious environmental effects for years. This editorial, originally published in Science [195(4274):137], argues that this generally held view has no factual basis, and that the environmental effects are far less long lived and severe.

C-1995-77
MAN'S IMPACT ON THE NATURAL ENVIRONMENT OF PENINSULAR MALAYSIA: SOME PROBLEMS AND HUMAN CONSEQUENCES
Aiken, S. R., and M. R. Moss. 1976.
Environmental Conservation 3(4):273-283.

Oil spills, Tankers, Environmental effects, Malaysia

Examples are selected to show the degree of man's impact on the natural environment of Malaysia and also the changing relationships between man and his environment. One case study describes the impact of oil spillage from grounded supertankers using the Straits of Malacca and Singapore and illustrates the international implications of a potentially widespread ecological disaster.

[from Applied Ecology Abstracts 3(5):#3D5731. 1977]

C-1996-77
ENVIRONMENTAL EFFECT OF OIL AND THE CHEMICALS USED TO CONTROL IT ON 3) THE SHORE AND SPLASH ZONES
Baker, J. M. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p.57-71.

Oil spills, Dispersants, Environmental effects, Shorelines, Intertidal zone, Marine organisms, Toxicity

A review is presented on the damage to the shoreline caused by oil pollution. Environmental effects can be documented by post-spill surveys, long-term monitoring schemes, field experiments on rocky, marshy, or sandy shores, and laboratory biological experiments on intertidal species. Parameters that affect shoreline damage include the volume, type, and physical state of the spilled oil, the frequency of oiling, the toxicity of dispersants or cleaning agents, and the shoreline topographic, hydrographic, and climatic conditions.

C-1997-77
WARTIME OIL POLLUTION (book review)
Bourne, W. R. P. 1977.
Marine Pollution Bulletin 8(7):167.

Oil spills, Environmental effects, U.S., Atlantic Ocean, *World War II

The book, Impact of Oil Spillage from World War II Tanker Sinkings (Campbell, B., E. Kern, and D. Horn, 1977. MIT Sea Grant Program Report No. 77-4. 85p.), is reviewed. The author criticizes the report for not researching pertinent ornithological literature for important environmental effects, and for the report's implication that current oil pollution risks from offshore developments are over-rated.

C-1998-77
OIL POLLUTION OF THE SEA
Cowell, E. B. 1976.
Marine Pollution. R. Johnston (ed.). London, Academic Press, 1976. p.353-401.

Sources, Contamination, Ships, Exploration, Production, Biological effects, Sea birds, Marine organisms, Fisheries, Spill cleanup, Dispersants

Oil pollution inputs into the marine environment from shipping, oil transfer operations, exploration and production, and other land based sources are reviewed. The effects of oil on seabirds and its acute and chronic effects on various marine communities (salt marshes, rocky shores and sandy to muddy coasts) are summarized. Methods of removing oil from the water or shoreline by mechanical means, absorption, burning, and washing with dispersants are discussed. Possible health hazards to animals and interactions of oil pollution with marine ecosystems are considered.

C-1999-77
SALT MARSHES OF PORT VALDEZ, ALASKA, AND VICINITY: A BASELINE STUDY
Crow, J. H. 1977.
Final report to the U.S. Department of the Interior. 113p.

Oil transport, Environmental effects, Oil spills, Vegetation, Soil, Marshes, Alaska

In 1974 and 1975, 62 baseline locations were selected for intensive study in the salt marshes of Port Valdez and vicinity. The sites are intended to reflect the impact of oil transport activities. Vegetation and soil characteristics were emphasized. Gold Creek and Sawmill Creek appear to be the marshes most susceptible to major oil spill damage, but all the marshes studied are threatened to some degree. An oil spill associated with seasonal high tides or during the winter when freshwater outflow is minimal would increase the potential hazard to the less vulnerable marsh areas.

C-2000-77
POLLUTION OF THE OCEANS BY OIL. I - DISTRIBUTION AND EFFECT OF OIL PRODUCTS IN THE MARINE ENVIRONMENT [in French]
Gérard, F. 1976.
La Météorologie, December:53-66.

Contamination, Oceans, Biological effects, Pollution control, Marine organisms, Dispersants

The sources of oil pollution, its biological impact, and the principal means of combatting it are surveyed. Biologically, the effects of dissolved oil must be considered as well as those of oil slicks. Data on lethal concentrations of oil for various types of plant and animal life are given along with data on the lethal effects of oil dispersant chemicals.

[from International Aerospace Abstracts 17(15):#A77-34279. 1977]

C-2001-77
THE ARGO MERCHANT OIL SPILL. A PRELIMINARY SCIENTIFIC REPORT
Grose, P. L., and J. S. Mattson. 1977.
Special report, NOAA-77042007. 338p.

Argo Merchant spill, Distribution, Environmental effects, Coasts, Atlantic Ocean

This report presents the available results from the investigations carried out to date by the many groups involved in the initial assessment of the distribution of the "Argo Merchant" oil spill and its impact. The fortunate aspects of the outcome of the spill are as follows: offshore winds which prevented the oil from coming on the beaches; the low density of the oil which resulted in no sinking of the oil and no bottom contamination; and occurrence of the spill in winter when biological activity and fishing activities are low.

[from Government Reports Announcements 77(16):#PB-267 505/6GA. 1977]

C-2002-77
MARINE POLLUTION
R. Johnston (ed.). 1976.
London, Academic Press, 1976. xiv + 729p.

Oil spills, Refineries, Oil transport, Offshore production, Pollution control, Toxicity, Birds, Fisheries, North Sea

The book is intended as an overview text for those in government, industry, and environmental protection dealing with pollution of the sea by toxic heavy metals, organic poisons, particulates including sewage and dredge spoils, and oil pollution. Eight contributed chapters cover mechanisms of pollution, biological effects of various pollutants with emphasis on fisheries resources and seabirds, pollutant dispersion in estuaries and inland waters, and international and national aspects of pollution control.

C-2003-77
MECHANISMS AND PROBLEMS OF MARINE POLLUTION IN RELATION TO COMMERCIAL FISHERIES
Johnston, R. 1976.
Marine Pollution. R. Johnston (ed.). London, Academic Press, 1976. p.3-156.

Crude oil, Aromatic hydrocarbons, Offshore development, Fisheries, North Sea

This chapter presents a synthesis of the major inputs of various marine pollutants, the mechanisms of pollution by different substances, and interactions between pollutants and commercial fish and shellfish resources. A major section deals with the effects of offshore North Sea oil development activities on commercial fisheries and their operations, and assesses the effects of crude oil and aromatic hydrocarbons on commercially important species of fish and mollusks.

C-2004-77
MARINE POLLUTION RESEARCH TITLES
Marine Pollution Information Centre. 1976.
Marine Pollution Research Titles 3(3):1-28.

Detection, Chemical analysis, Spill cleanup

The title publication includes 205 selected references on marine and estuarine pollution divided into a dozen chapters. Oil pollution is covered in detail, especially its detection, analysis, characteristics, and removal.

[from Selected Water Resources Abstracts 10(11):#W77-05383. 1977]

C-2005-77
THE EFFECTS OF PETROLEUM HYDROCARBONS ON MARINE POPULATIONS AND COMMUNITIES
Michael, A. D. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p.129-137. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Environmental effects, Chronic effects, Marine organisms, Contaminants, Oil spills

Recent literature on the effects of petroleum hydrocarbons on marine life and ecosystems is reviewed from the standpoint of assessing the current status of research. Included are the effects of oil spills or chronic contamination on plankton, intertidal and subtidal benthos, fisheries, birds, and mammals. Future research priorities suggested include long-term study of oil spills and chronic contamination, and field and laboratory studies of sublethal effects of pollution.

C-2006-77
PENETRATION OF CRUDE OIL DISTILLATION PRODUCTS THROUGH SOIL AND THEIR EFFECT OF [sic] MICROORGANISMS IN SOIL AND WATER [English summary]
Milkowska-Jankowska, D., J. Maleszewska, and J. Luzak. 1976.
Roczniki Panstwowego Zakladu Higieny 27(6):679-687.

Petroleum products, Lubricating oil, Movement, Soil, Bacteria, Biological effects

"Motor oils Marinol 211D and Lux 5 rapidly passed through soil samples in conjunction with water. Pollution of soils with the oils lowered the organoleptic properties of water passing through them. The oils enhanced the development of N-reducing bacteria in the soil."

[from Chemical Abstracts 86(25):#184188x. 1977]

C-2007-77
ENVIRONMENTAL EFFECTS OF FOSSIL FUELS
Morris, S. C. 1976.
Energy and the Environment: Cost-Benefit Analysis. Proceedings of a Conference, Georgia Institute of Technology, Atlanta, June 23-27, 1975. R. A. Karam, and K. Z. Morgan (eds.). Elmsford, N.Y., Pergamon Press, 1976. p.330-344.

Fuels, Production, Contaminants, Environmental effects

"A review on pollutants associated with fuels and energy-producing processes with 38 references."

[from Chemical Abstracts 87(2):#10533m. 1977]

C-2008-77
MEDICAL-BIOLOGICAL AND ECOLOGICAL ASPECTS OF POLLUTION OF THE OCEANS [English summary]
Ricci, G. C. 1975.
Annali di Medicina Navale 80(3-4):289-406.

Hydrocarbons, Contamination, Oceans, Biological effects, Health hazards, Pollution control

Environmental and medical-biological aspects of ocean contamination by various pollutants including hdyrocarbons are summarized. The interaction of pollutants, the physical, biological and chemical mechanisms of pollution, self-purification of the sea, and anti-pollution measures are also discussed.

[from Chemical Abstracts 87(2):#11172e. 1977]

C-2009-77
ENVIRONMENTAL EFFECT OF OIL AND THE CHEMICALS USED TO CONTROL IT ON 2) FISHERIES
Shelton, R. G. T. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p.51-56.

Fisheries, *Shellfish, Contamination, Environmental effects

Oil pollution is a potential threat to fish and shellfish resources because: 1) the pollution may directly kill or harm the fish or shellfish stocks; 2) oil contaminants on or in the animals may render them unacceptable for consumption, and 3) spilled oil may physically interfere with fishing operations.

C-2010-77
ENVIRONMENTAL EFFECT OF OIL AND THE CHEMICALS USED TO CONTROL IT ON 1) PLANKTON
Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p.47-50.

Oil slicks, Phytoplankton, Environmental effects, Dispersants, Toxicity, *Light reduction, *Photosynthesis

The environmental effects of oil slicks on plankton are threefold: the oil layer reduces photosynthesis in phytoplankton by occluding light; oil interferes with oxygen exchange at the sea surface, and oil and dispersants exert serious toxic effects on plankton.

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL EFFECTS

C-2011-77
HEALTH EFFECTS OF OIL SHALE PROCESSING
Coomes, R. M. 1976.
Quarterly of the Colorado School of Mines 71(4):101-123.

Oil shale, Extraction, Carcinogens, Health hazards, *Benzo(a)pyrene

The benzo(a)pyrene content of crude shale oil was found to be the same order of magnitude as that of petroleum products and can be reduced by hydrotreating or upgrading of the shale oil. Processed shale was enriched in benzo(a)pyrene but contained less than many natural materials considered to be noncarcinogenic. Test animals exposed to large quantities of processed shale during their lifetime developed no skin cancers.

[from Chemical Abstracts 87(2):#10803z. 1977]

C-2012-77
FISHING AND NORTH SEA OIL
MacArthur, G.P.S. 1976.
Scottish Fisheries Bulletin 43:27-31.

Fisheries, Oil industry, Offshore development, North Sea, Scotland

This paper describes the current status of the oil exploitation industry and its cooperative interactions with the fishing industry of Scotland. Emphasis is given to oil-related debris and to offshore installations and their future effects, including pollution.

[from Aquatic Sciences & Fisheries Abstracts 7(7):#7Q7842. 1977]

C-2013-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 1: MARINE MAMMALS, MARINE BIRDS
National Oceanic and Atmospheric Administration. 1976. 601p.

Offshore development, Environmental effects, Baseline studies, OCS, Alaska, Mammals, Birds

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaska Continental Shelf. The multi-year program is sponsored by the Bureau of Land Management.

[from Selected Water Resources Abstracts 10(14):#W77-06793. 1977]

C-2014-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS FOR THE YEAR ENDING SEPTEMBER 1976. VOL. 2: FISH, PLANKTON, BENTHOS, LITTORAL
National Oceanic and Atmospheric Administration. 1976. 535p.

Offshore development, Environmental effects, Baseline studies, OCS, Fish, Plankton, Benthos, Alaska

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is sponsored by the Bureau of Land Management.

[from Selected Water Resources Abstracts 10(14):#W77-06825. 1977]

C-2015-77
SHOREBIRD DEPENDENCE ON ARCTIC LITTORAL HABITATS
Risebrough, R. W., and P. G. Connors. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending September 1976. Vol. 1, Marine Mammals, Marine Birds. p.404-408.

Birds, Habitat, Shorelines, Arctic, Offshore development, Environmental effects, Alaska, *Shorebird species

To assess the degree and nature of dependence of each shorebird species on arctic habitats which may be susceptible to disturbance from offshore development, 3 major areas must be investigated: seasonal occurrence of shorebirds by species in several arctic littoral habitats; foraging habitat preferences within the littoral zone by species; and diets of shorebirds in the littoral zone by species. About 500 transect censuses were completed during this period; results are compared to data obtained from the 1975 studies.

[from Selected Water Resources Abstracts 10(14):#W77-06811. 1977]

C-2016-77
AVIFAUNAL UTILIZATION OF THE OFFSHORE ISLAND AREA NEAR PRUDHOE BAY, ALASKA
Schamel, D. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending, September 1976. Vol. 1, Marine Mammals, Marine Birds. p.409-447.

Birds, Shorelines, Offshore development, Oil spills, Environmental effects, Baseline studies, Alaska

Changes in numbers and activity patterns of avifauna over time and space were documented. Census work was conducted on Egg

Island, a barrier inlet on the Beaufort Sea coast which was found to have the greatest concentration of nesting Eiders in the area. The most numerous birds in the area (Common Eiders, King Eiders, and Oldsquaw) are all highly susceptible to oil spills. Oil development on these islands could interfere with nesting of the Common Eiders and, to a lesser extent, the King Eiders.

[from Selected Water Resources Abstracts 10(14):#W77-06812. 1977]

C-2017-77
EPA RESEARCH PROGRAM ON THE FRESHWATER ECOLOGICAL EFFECTS OF ENERGY DEVELOPMENT AND USE
Yount, J. D. 1976.
National Conference on Health, Environmental Effects, and Control Technology of Energy Use, Washington, D.C., 1976.

Oil transport, Pipelines, Environmental effects, Freshwater, Arctic, EPA

Described is the EPA freshwater ecological effects program which concentrates on coal mining, transport, and energy conversion; and oil transport by pipeline from arctic oil fields.

[from ERDA Energy Research Abstracts 2(11):#26768. 1977]

2. ECONOMIC EFFECTS

C-2018-77
TOUGHER WATER STANDARDS SEEN HIKING CONSUMERS' FUEL COSTS (news brief)
Anon. 1977.
Oil and Gas Journal 77(27):27.

Oil industry, Regulations, U.S., Cost analysis, Water quality, Pollution prevention

Compliance with the proposed 1983 federal water pollution control standards will cost the U.S. oil industry an estimated $4.2 billion, but will do little to improve water qualtiy. A recent Battelle study suggests that a strategy based on preventing new pollution and not only focusing on cleanup efforts might be a more cost effective approach.

C-2019-77
THE ECONOMIC IMPACT OF ENVIRONMENTAL REGULATIONS ON THE PETROLEUM INDUSTRY - PHASE II STUDY
Sheppard, W., et al. 1976.
API Report. 357p.

Oil industry, Regulations, Pollution prevention, Economic effects, Cost analysis

Estimates are presented of the cost to the entire oil industry of meeting existing and future (up to 1985) environmental regulations. Annual costs were estimated at $3.2 billion in 1973, and will be $10.3 billion in 1985. Cumulative capital investments, $7.9 billion in 1973, are estimated to be $28.9 billion in 1985. The analysis includes environmental protection costs incurred during exploration and production, transport, refining, distribution, and marketing. The cost-effectiveness of selected pollution abatement technologies is assessed.

[from Energy Information Abstracts 2(2):#77-21485. 1977]

3. GENERAL EFFECTS

C-2020-77
EKOFISK BRAVO BLOWOUT - THE MILLION BARREL WARNING
Anon. 1977.
Noroil 5(5):45,47-49.

Ekofisk blowout, Offshore development, North Sea, Environmental protection, Safety, Regulations

The widely publicized Ekofisk Bravo platform blowout in the North Sea is expected to have serious repercussions, and offshore development in the North Sea will undergo intense and critical scrutiny from both governments and the public. The long and bitter debate over oil development vs. environmental protection is renewed, and, with certainty, tough new safety regulations will go into effect.

[from Petroleum Abstracts 17(28):#235,494. 1977]

C-2021-77
MINERAL RESOURCE MANAGEMENT OF THE OUTER CONTINENTAL SHELF
Adams, M. V., C. B. John, R. F. Kelley, A. E. laPointe, and
R. W. Meurer. 1976.
U.S. Geological Survey, Circ-720. 37p.

Environmental management, OCS, Offshore drilling, Fossil fuels, Regulations, Pollution control

OCS oil and gas production represents an increasing percentage of total U.S. production, as onshore production has declined and offshore production has increased. Improved technology and enforcement of more stringent regulations have made offshore operations safer, but it is unrealistic to believe that completely accident-free operations can ever be achieved. Management of OCS mineral resources will become an increasingly significant function.

[from Government Reports Announcements 77(15):#N76-76745/8GA. 1977]

C-2022-77
SOCIAL AND ECONOMIC IMPACT ASSESSMENT OF ALASKA OUTER CONTINENTAL SHELF PETROLEUM DEVELOPMENT
Alaska University,College. Sea Grant Program. 1975.
Study plan report, Sea Grant-75-15, NOAA-76050604; Contract DI-AA550-CT6-2. 100p.

Offshore drilling, Socio-economic effects, OCS, Crude oil, Alaska, *Sea Grant program, *Energy policy

Physical, economic, social, individual human, and political effects and interrelations are considered in this report. The study is organized in geographic units - the state of Alaska, regions specific to the oil and gas development, and local communities within the regions.

[from Government Reports Announcements 76(18):#PB-254 669. 1977]

C-2023-77
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS: VOLUME IV. PETROLEUM REFINING INDUSTRY REPORT
Arthur D. Little, Inc. 1976.
Final report, EPA/600/7-76/034d; Contract EPA-68-03-2198. 193p.

Oil industry, Refining, Environmental effects, Pollution control, *Technology assessment

Volume IV assesses the likelihood of new process technology in the petroleum refining industry and explores the environmental impact of such changes. Five options are examined in terms of process economics and environmental energy consequences: 1) direct combustion of asphalt in process heaters and boilers; 2) hydrocracking of vacuum bottoms; 3) flexicoking of vacuum bottoms; 4) internal electrical power generation; and 5) hydrogen generation by partial oxidation.

C-2024-77
PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE, GULF OF MEXICO: OCS SALE 44. FINAL ENVIRONMENTAL IMPACT STATEMENT. VOLUME 1
Berklund, C. 1976.
Washington, D.C., Bureau of Land Management, 1976. 405p.

Oil-gas leasing, OCS, Environmental effects, EIS, Gulf of Mexico

Sixty-one tracts of 102,991 ha (254,488 acres) of OCS land located offshore Texas and Louisiana have been proposed for leasing action. If implemented, the sale was tentatively scheduled to be held in November, 1976. All tracts pose some degree of pollution risk to the environment. Methods used to evaluate the environmental impacts of the proposed leasing, exploration, and production are described and alternatives to the proposed action are considered.

[from ERDA Energy Research Abstracts 2(10):#24923. 1977]

C-2025-77
PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE, GULF OF MEXICO: OCS SALE 44. FINAL ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2
Berklund, C. 1976.
Washington, D.C., Bureau of Land Management, 1976.

Oil-gas leasing, OCS, Environmental effects, EIS, Gulf of Mexico

Maps of tracts of 102,991 ha (254,488 acres) proposed for leasing in the Gulf of Mexico are in the packet. Other information given includes: lease status, recreation, historic and archeological resources, geologic and geomorphic features, and endangered wildlife and natural vegetation.

[from ERDA Energy Research Abstracts 2(10):#24924. 1977]

C-2026-77
PETROCHEMICAL INDUSTRY - A CHALLENGE FOR ANALYTICAL CHEMISTS [English summary]
Boeler, J. B. 1975.
Kjemi 35(7):4-5.

Petrochemicals, Chemical analysis, Wastewater treatment, Pollution control, Norway

Pollution problems of the Norwegian petrochemical industry are reviewed.

[from Chemical Abstracts 86(26):#192111g. 1977]

C-2027-77
GULF OF ALASKA AND BERING SEA OCS STUDIES - AN OVERVIEW
Bruce, H. E. 1976.
Oceans '76 Conference, Washington, D.C., 1976. p.23A-26A.

Offshore exploration, Oil-gas leasing, Environmental effects, OCS, Gulf of Alaska, Bering Sea

Activities and results of the first two years of an environmental assessment program involving the Gulf of Alaska and Bering Sea are described. The study includes environmental evaluations of nine potential petroleum lease areas extending from the Gulf of Alaska to the Beaufort Sea.

[from Environment Abstracts 7(5/6):#77-03177. 1977]

C-2028-77
FINAL ENVIRONMENTAL STATEMENT. VOL. I, PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE OFFSHORE SOUTHERN CALIFORNIA (O.C.S. SALE NO. 35)
Bureau of Land Management. 1975. 709p.

Oil-gas leasing, EIS, Environmental effects, Baseline studies, Southern California

In Volume I, a description of the proposed lease region is followed by a description of the environment in this part of the offshore area of Southern California. The proposed federal action under consideration is the leasing of 297 tracts in this region.

[from Selected Water Resources Abstracts 10(11):#W77-05536. 1977]

C-2029-77
FINAL ENVIRONMENTAL STATEMENT. VOL. 2, PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE OFFSHORE SOUTHERN CALIFORNIA (O.C.S. SALE NO. 35)
Bureau of Land Management. 1975. 767p.

Oil-gas leasing, EIS, Environmental effects, Offshore development, Baseline studies, Southern California

The general environmental impacts of offshore oil and gas operations are described. Development and production activity could result in a variety of impacts on the natural environment, Channel Island area resources, air and water qualtiy, land use patterns, the social order, and the economy.

[from Selected Water Resources Abstracts 10(11):#W77-05537. 1977]

C-2030-77

FINAL ENVIRONMENTAL STATEMENT. VOL. 3, PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE OFFSHORE SOUTHERN CALIFORNIA (O.C.S. SALE NO. 35)
Bureau of Land Management. 1975. 857p.

Oil-gas leasing, EIS, Environmental effects, Baseline studies, Southern California

Volume 3 contains the documentation dealing with the consultation and coordination with agencies in the preparation of the draft EIS. Also included are the records of various public hearings and the review of the draft EIS leading to the preparation of the final environmental statement.

[from Selected Water Resources Abstracts 10(11):#W77-05538. 1977]

C-2031-77

FINAL ENVIRONMENTAL STATEMENT. VOL. 4, PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE OFFSHORE SOUTHERN CALIFORNIA (O.C.S. SALE NO. 35)
Bureau of Land Management. 1975. 886p.

Oil-gas leasing, EIS, Environmental effects, Offshore development, Baseline studies, Southern California

This volume comprises 27 appendices of details including summary descriptions of environmental conditions and pollution effects of oil-gas resource development offshore Southern California. It also includes a history of oil and gas operations, summary of regulations concerning hazards to navigation, and a list of significant felt earthquakes in the region.

[from Selected Water Resources Abstracts 10(11):#W77-05539. 1977]

C-2032-77

FINAL ENVIRONMENTAL STATEMENT. VOL. 5, PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE OFFSHORE SOUTHERN CALIFORNIA (O.C.S. SALE NO. 35)
Bureau of Land Management. 1975. n.p.

Oil-gas leasing, Offshore development, EIS, Environmental effects, Baseline studies, Southern California

The graphics, maps, and charts illustrating the lease sale area offshore Southern California are described and include: potential use conflicts, rare and endangered species, land use, air basins, winds and vegetation, aesthetics, commercial fisheries, sport fishing, marine mammals, shoreline types, geology, tectonics, bottom sediments, and impact potential.

[from Selected Water Resources Abstracts 10(11):#W77-05540. 1977]

C-2033-77
FINAL ENVIRONMENTAL STATEMENT: PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE, LOWER COOK INLET
Bureau of Land Management. 1976.
Vol. 1-2. 1405p.

Oil-gas leasing, OCS, EIS, Environmental effects, Socio-economic effects, Alaska

About 360,000 ha (0.9 million acres) of OCS tracts, situated in 35-80 m water depths, are tentatively scheduled for oil-gas leasing in 1977. The environmental risks from chronic oil pollution or accidental spills are assessed, and socio-economic impacts of offshore development are projected. Although some risks can be mitigated, some impacts are considered unavoidable.

[from Energy Information Abstracts 2(2):#77-21486. 1977]

C-2034-77
OIL UNDER ICE (book review)
Casey, S. 1977.
Alternatives 6(4):35.

Offshore exploration, Offshore development, Environmental effects, Canada, Arctic, Ice, Oil industry

The publication, Oil Under Ice (Pimlott, D., D. Brown, and K. Sam. Ottawa, Canadian Arctic Resources Committee, 1976. 161p.), is reviewed as a serious, well-documented indictment of Canada's "energy-industry first" exploration policies. The book details the physical environment of the Beaufort Sea, Arctic Archipelago, Hudson's Bay, and Lancaster Sound,and critically examines Canada's environmental assessment programs and offshore exploration and development policies.

C-2035-77
POSSIBLE CONTAMINATION OF GROUND WATERS BY OIL AND GAS-WELL DRILLING AND COMPLETION FLUIDS
Collins, A. G. 1975.
Environmental Aspects of Chemical Use in Well-drilling Operations, Houston, 1975. 37p.

Contamination, Groundwater, Drilling, Oil wells, *Drilling fluids, *Well completion

Chemicals used in the drilling fluids and in well completion and treatment are listed; several of them are quite capable of polluting water and land. The compositions of some oilfield brines and crude oils which can be used to prepare drilling fluids are listed. Possible ways in which drilling fluids and well operations may contaminate ground water are outlined, and methods for rehabilitating a contaminated aquifer are discussed.

[from ERDA Energy Research Abstracts 2(11):#25906. 1977]

C-2036-77
THE ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM
Falk, M. R. 1976.
Canadian Society of Environmental Biologists Meeting , 17th, Ottawa, Canada, 1976. p.40-43.

Tar sands, Development, Extraction, Environmental protection, Canada, *Alberta

"The Alberta Oil Sands Environmental Research Program will undertake a 10 year, $40 million investigation into the Athabasca oil sands area to ensure acceptable environmental quality during and after development. The programs, the nature of oil sands, and mining and processing methods are described."

[from Environment Abstracts 7(5/6):#77-03006. 1977]

C-2037-77
MORBIDITY AND MORTALITY OF MARINE MAMMALS
Fay, F. H. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending September, 1976. Vol. 1, Marine Mammals, Marine Birds. p.43-47.

Offshore development, Biological effects, Marine mammals, OCS, Alaska, *Mortality

In a survey for dead or moribund marine mammals on the coast of Kotzebue Sound from Bering Strait to Point Hope, a total of 166 dead mammals were sighted, 92 of which were old weathered remains of previous years. Findings suggest that 2 pathologic conditions, dermatomycosis and streptococcosis, occur frequently and that their rate of occurrence and the potential aggravation by the stresses of oil development activities merit further investigation.

[from Selected Water Resources Abstracts 10(15):#W77-07405. 1977]

C-2038-77
MID-ATLANTIC OUTER CONTINENTAL SHELF BENCHMARK STUDIES
Jacobson, J. P., and M. P. Lynch. 1976.
Oceans '76 Conference, Washington, D.C., 1976. p.18B-23B.

Baseline studies, OCS, Atlantic coast, Offshore development, Hydrocarbons, Chemical analysis

A multidisciplinary environmental baseline studies program was undertaken for the OCS area off the coast of New Jersey, Delaware, Maryland, and Virginia in order to determine pre-drilling environmental conditions, and to assess possible impacts of oil-gas development. Hydrocarbon analyses of sediments, benthos, zooplankton, and suspended matter were conducted, and supportive physical, chemical, and geological data were gathered.

[from Environment Abstracts 7(5/6):#77-03175. 1977]

C-2039-77
MONITORING ENVIRONMENTAL IMPACTS OF THE COAL AND OIL SHALE INDUSTRIES: RESEARCH AND DEVELOPMENT NEEDS
Jones, D. C., W. S. Clark, W. F. Holland, J. C. Lacy, and E. D. Sethness. 1977.
Final report, EPA/600/7-77/015; Contract EPA-68-02-1319. 207p.

Oil shale, Industries, Environmental effects, Monitoring, *R & D needs

Presented are recommendations for the monitoring and predictive technology for the coal and oil shale industries. Information is based upon a literature survey of the emissions and potential impacts of these industries.

[from Government Reports Announcements 77(15):#PB-266 292/2GA. 1977]

C-2040-77
PROTECTING THE ENVIRONMENT
McCormack, M. M. 1976.
Encyclopedia of Energy. New York, McGraw-Hill Book Co., 1976. p.49-55.

Production, Fossil fuels, Oil shale, Tar sands, Environmental effects

The environmental impacts of producing and utilizing fossil and nuclear fuels are investigated. The effects of producing coal, oil, natural gas, uranium, oil shale, tar sands, and geothermal energy are specifically examined.

[from Petroleum Abstracts 17(32):#236,706. 1977]

C-2041-77
UPTAKE IN MARINE LIFE: CHEMICAL STUDIES OF OFFSHORE OIL PLATFORMS
McDermott-Ehrlich, D., and G. A. Alexander. 1976.
Coastal Water Research Project: Annual Report for the Year Ended 30 June 1976. El Segundo, CA, Southern California Coastal Water Research Project, 1976. p.129-135.

Offshore drilling, Platforms, Uptake, Marine organisms, Sediments, Southern California

Levels of copper, zinc, hexane extractable materials, and volatile solids in sediments around oil platforms were similar to average coastal background levels and well below levels observed in sediments contaminated by the largest municipal wastewater discharges in Southern California. In the sediments, only weathered oils were detected, indicating no recent spills.

[from Aquatic Sciences & Fisheries Abstracts 7(6):#7Q7516. 1977]

C-2042-77
COASTAL OCEANOGRAPHIC PROCESSES
Manowitz, B. 1975.
Conference on Computer Support of Environmental Science and Analysis, Albuquerque, 1975.

Offshore drilling, Environmental effects, Contaminants, Coasts, Fish

The impact on coastal zones by offshore nuclear reactors and oil well drilling related activities, especially to the eggs and larvae of dominant fish species, is discussed. The transport and diffusion of potentially released contaminants, particularly in the near shore zone, are also covered.

[from ERDA Energy Research Abstracts 2(12):#30858. 1977]

C-2043-77
THE BUREAU OF LAND MANAGEMENT OCS ENVIRONMENTAL STUDIES PROGRAM - A DECISION MAKING ORIENTATION
Monastero, F. C. 1976.
Oceans '76 Conference, Washington, D.C., 1976. p.18A-20A.

Environmental effects, OCS, BLM, Offshore development

The objectives and the rationale behind the design and implementation of the title program and related BLM studies are explained and discussed.

[from Environment Abstracts 7(5/6):#77-03174. 1977]

C-2044-77

THE IMPACTS OF OUTER CONTINENTAL SHELF DEVELOPMENT ON LAFOURCHE PARISH
Mumphrey, A. J., Jr., F. W. Wagner, G. D. Carlucci, Jr., M. J. Landry, and J. C. Miller, Jr. 1976.
NOAA-77021610. 391p.

Oil industry, Offshore drilling, Environmental effects, Economic effects, OCS, Louisiana

This study deals with the impacts of OCS mining activity on Lafourche Parish in terms of employment, income, job types, environmental effects, and supporting facilities and services.

[from Government Reports Announcements 77(11):#PB-264 992/9GA. 1977]

C-2045-77

PROGRAM DEVELOPMENT PLAN. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF
National Oceanic and Atmospheric Administration. 1976.
NOAA-77032913. 269p.

Offshore development, Crude oil, OCS, Environmental effects, Oil-gas leasing, Alaska

This plan was developed by the interdisciplinary staff of the NOAA Outer Continental Shelf Environmental Assessment Program Office with input from the Bureau of Land Management, State of Alaska, and Users Panel composed of representatives from several federal and state agencies and private environmental groups.

[from Government Reports Announcements 77(15):#PB-266 337/5GA. 1977]

C-2046-77

WHO'S MINDING THE SHORE. A CITIZENS' GUIDE TO COASTAL MANAGEMENT
Natural Resources Defense Council. 1976.
Report to NOAA, Office of Coastal Zone Management. 56p.

Offshore development, Environmental management, Coasts, Guidelines, *CZM

Coastal zone management is described and a catalog of what people can do to become actively involved in their state's program is given. The requirements of an effective program are considered, and the natural conditions existing in the the coastal ecosystems and the areas which are vital to their preservation are outlined. Two of the most serious development pressures in the coastal zone - offshore oil production and residential subdivisions - are considered with their problems for the design of a management program.

[from Selected Water Resources Abstracts 10(14):#W77-06935. 1977]

C-2047-77
COASTAL EFFECTS OF OFFSHORE ENERGY SYSTEMS
Office of Technology Assessment. 1976.
U.S. Congress Office of Technology Assessment report. Vol. 1. 306p.

Offshore development, Ports, Atlantic coast, Environmental deterioration

The construction and operation of offshore energy systems are analyzed for adverse effects on the Mid-Atlantic U.S. coastal region. Included in the assessment are floating nuclear power plants, offshore oil-gas development, and supertanker deepwater ports. No significant environmental degradation is expected to result from the presently anticipated magnitude of oil-gas development and supertanker port construction.

[from Energy Information Abstracts 2(2):#77-21487. 1977]

C-2048-77
WORKING PAPERS, COASTAL EFFECTS OF OFFSHORE ENERGY SYSTEMS, AN ASSESSMENT OF OIL AND GAS SYSTEMS, DEEPWATER PORTS AND COAST OF NEW JERSEY AND DELAWARE
Office of Technology Assessment. 1976.
U.S. Congress Office of Technology Assessment report. Vol. 2. 865p.

Offshore development, Ports, Environmental effects, Fisheries, Atlantic coast, New Jersey, Delaware

Offshore oil-gas development and the siting of deepwater ports and floating nuclear power plants off the coast of Delaware and New Jersey are assessed for environmental effects. Biological repercussions of offshore drilling were surveyed. Commercial fishing was found to be unaffected by the presence of oil rigs, and ecosystem impacts were relatively minor.

[from Energy Information Abstracts 2(2):#77-21488. 1977]

C-2049-77
OUR COASTAL WATERS: AN ENDANGERED ZONE
Pearce, J. B. 1976.
The Science Teacher 43(9). 4p.

Contamination, Coasts, Estuaries, Development, Oil industry

Discussed are the phenomenon of "coastal congestion", brought about by the development and increased population of the coastal and estuarine environments, and the threat to these areas caused by pollution from sewage and sludge, petroleum and power plants, and by mineral resource development.

C-2050-77
INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 5. BASIC PETROCHEMICALS INDUSTRY
Radian Corp. 1977.
Report for August 75-November 76, EPA/600/2-77/023e; Contract EPA-68-02-1319. 155p.

Oil industry, Petrochemicals, Environmental effects, Refineries

This catalog was developed to aid in defining the environmental impacts of U.S. industrial activity. Entries for each industry form separate chapters of the catalog. The petroleum industry includes companies that treat hydrocarbon streams from the oil refining industry, as well as natural gas liquids from the oil and gas production industry. From these raw materials, materials are produced for the organic chemicals industry.

[from Government Reports Announcements 77(15):#PB-266 224/5GA. 1977]

C-2051-77
MINING TECHNOLOGY FOR OFFSHORE HYDROCARBON DEVELOPMENT
Snyder, H. L. 1977.
CIM Bulletin 70(778):62-69.

Offshore development, OCS, Ice, Safety, Labrador Sea, *Mining technology

Current technology is not adequate for safeguarding offshore oil-gas production on the Labrador continental shelf, as the area is infested with icebergs and pack ice. The author believes that mining beneath the ocean floor, as practiced at Bell Island and Cape Breton, may utilize the technology which would also allow for safe, economical, and reliable oil production.

[from The Engineering Index Monthly 15(6):#042590. 1977]

C-2052-77
EFFECTS OF OFFSHORE OIL & NATURAL GAS DEVELOPMENT ON THE COASTAL ZONE
U.S. Library of Congress. Congressional Research Service. 1976.
Washington, D.C., U.S. Government Printing Office, 1976. 396p.

Offshore development, OCS, Coasts, Onshore impacts, Environmental effects, Pollution prevention

This comprehensive government study evaluates the U.S. offshore oil & gas resources, including projected environmental and socio-economic effects of onshore and offshore petroleum development. It also covers current OCS development regulations, congressional actions for changing regulations, and compensation to the coastal states. There are chapters concerning environmental impacts offshore, in the coastal zone, and on the fishing industry, including blowout and spill prevention technology, probabilities of oil spills and blowouts, and containment and cleanup technology.

C-2053-77
THE OIL INDUSTRY AND COASTAL ZONE MANAGEMENT IN LOUISIANA
Van Lopik, J. R. 1976.
26th Annual Gulf Coast Association Geological Societies Meeting Transactions 26:349-353. Held at Shreveport, Louisiana, October 13-15, 1976.

Oil industry, Environmental management, Coasts, Louisiana, Legislation, U.S.

The Federal Coastal Zone Management Act of 1972 provides incentives for states to plan and implement management programs to guide the use of lands and waters in the coastal zone. Several coastal zone bills have been prepared for consideration by the Louisiana legislature during the 1976 session. In these guidelines, a comprehensive assessment of techniques will be required to mitigate the effects of such activities as brine disposal, pipelaying, spoil disposal, and the construction and operation of processing plants, storage facilities, and refineries.

[from Petroleum Abstracts 17(31):#236,384. 1977]

C-2054-77
OCS ENVIRONMENTAL RESEARCH TECHNOLOGY IN ICE-COVERED WATERS
Weller, G. 1976.
Oceans '76 Conference, Washington D.C., 1976. p.23D-25D.

Offshore development, Arctic, Ice, Environmental effects, *Ice-covered water, *Research technology

Offshore development-related environmental assessment programs in the Arctic must deal with ice-infested or ice-covered waters for nine to ten months each year. This paper describes technological developments and specially developed methods and equipment which have made it possible to conduct research in the coastal arctic marine environment year round.

[from Environment Abstracts 7(5/6):#77-03179. 1977]

C-2055-77
STATE INFORMATION NEEDS RELATED TO ONSHORE AND NEARSHORE EFFECTS OF OCS PETROLEUM DEVELOPMENT
Williams, D. C., P. R. Stang, and B. Hyde. 1977.
Report NOAA-77031402. 191p.

Offshore development, OCS, Coasts, U.S., Environmental effects, Socio-economic effects, State governments

In response to widespread OCS development along U.S. coasts, this report identifies the environmental, social, and economic impacts of oil development and attendant oil pollution, and discusses state policies, organization and planning approaches, and major concerns.

[from Government Reports Announcements 77(13):#PB-266 001/7GA. 1977]

C-2056-77
FATE OF DRILL CUTTINGS IN THE MARINE ENVIRONMENT
Zingula, R. P., and D. W. Larson. 1977.
SPE of AIME Offshore Technology Conference, 9th, Houston, 1977.
No. OTC-3040. p.553-556.

Drilling, *Drill cuttings, Fate, Biological effects, Oceans

By use of sidescan sonar, scuba, and underwater photography, studies have revealed that adverse effects are minimal and short-lived, and in some instances the accumulation of cuttings from offshore wells may be beneficial. Modification of normal mud and cuttings discharge procedures would be needed only in unusual circumstances.

[from Petroleum Abstracts 17(27):#235,276. 1977]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-2057-77
ARCTIC HYDROCARBON DEGRADATION
Arhelger, S. D., B. R. Robertson, and D. K. Button. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 270-275. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Biodegradation, Microorganisms, Arctic Ocean, *^{14}C-dodecane oxidation, *Port Valdez

Supplemented sterile seawater was inoculated with raw seawater samples and examined for oil related microbial activity. Microbial populations of 10^3 to 10^5/L were indicated. *In situ* ^{14}C-dodecane oxidation rates based on $^{14}CO_2$ recovery were: Port Valdez, 0.7 g/L day; Chukchi Sea, 0.05 g/L day; and Arctic Ocean, 0.001 g/L day.

C-2058-77
STUDIES ON PETROLEUM BIODEGRADATION IN THE ARCTIC
Atlas, R. M. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 261-269. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Biodegradation, Crude oil, Microorganisms, Arctic, Beaufort Sea

Oil-degrading microorganisms were widely distributed in the Beaufort and Chukchi Seas, but constituted only a low percentage of the indigenous microbial populations. Concentrations of hydrocarbon-utilizing microorganisms were lower in ice than in water or sediment. Rates of biodegradation were found to be limited by temperature and available nitrogen and phosphorus. Biodegradation of all oil component classes apparently proceeded at similar rates.

C-2059-77
PROCESS AND APPARATUS FOR THE MICROBIAL DEGRADATION OF CRUDE OIL, OF CRUDE FRACTIONS AND OF VARIOUS ORGANIC CONTAMINANTS
Azarowicz, E. N. 1977.
French Patent 2,320,912.

Biodegradation, Crude oil, Petroleum products, Bacteria, Patent, *Nutrient addition

A suitable nutrient is added to the contaminated water along with at least one of the following microorganisms: *Candida parapsilosis* ATCC 20246, *C. tropicalis* ATCC 20247, *C. utilis* ATCC 20248, *C. lipolytica* ATCC 20255, 20362, 20363, and 20364, *Penicillium* sp. 20339, or one of their mutants. After agitation and aeration of the mixture, it is then fed to a final degradation basin and a new charge of one of the above microorganisms is added together with a new charge of nutrient.

[from Petroleum Abstracts 17(30):#235,877. 1977]

C-2060-77

EMULSIFICATION OF HYDROCARBONS BY BACTERIA FROM FRESHWATER ECOSYSTEMS

Broderick, L. S., and J. J. Cooney. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. N63. Abstract.

Biodegradation, Hydrocarbons, Bacteria, Emulsification, Freshwater, *Kerosene

Bacteria which utilize hydrocarbons as a sole carbon source were studied for their ability to form stable emulsions of kerosene and water. All of the organisms which grew on kerosene also emulsified kerosene. However, there was no correlation between the observed emulsifying activity and the history of hydrocarbon pollution of the ecosystems from which the organismswere isolated.

C-2061-77

ENRICHMENT FOR ESTUARINE PETROLEUM-DEGRADING BACTERIA USING LIQUID AND SOLID MEDIA

Calomiris, J. J., B. Austin, J. D. Walker, and R. R. Colwell. 1977.
Journal of Bacteriology 42:135-144.

Biodegradation, Bacteria, Estuaries, *Enrichment techniques

Bacteria in oil-contaminated and oil-free estuarine water and sediment were isolated on solid and in liquid petroleum media. A greater variety of bacteria was noted when direct plating techniques were employed, compared with liquid enrichment. Strains isolated by liquid enrichment were found more frequently to be capable of utilizing model petroleum in vitro, compared with isolates obtained by direct plating.

C-2062-77
INTERACTIONS OF ARABIAN CRUDE OIL WITH BEACH SEDIMENT BACTERIA
Colwell, R. R., J. D. Walker, B. F. Conrad, and P. A. Seesman.
1977.
Final report, EPA Grant No. 68-01-3284. 78 p.

Biodegradation, Hydrocarbons, Bacteria, Sediment, Beaches,
Strait of Magellan, Metula spill

Beach sediment samples collected in the Straits of Magellan were examined for petroleum hydrocarbons and found to contain significant amounts of oil, with the concentration of oil related to degree of exposure to the "Metula" spill. The total number of viable, aerobic, heterotrophic microorganisms in the samples was found to decrease with increasing oil concentration. More rapid glucose uptake and mineralization by microorganisms were observed in clean sediment samples. Good growth in Arabian crude oil medium was obtained for most samples; however, the extent of degradation varied considerably with rate of removal of the major components of the oil. High concentrations of oil appeared to affect biodegradation adversely.

C-2063-77
EFFECT OF CHLORINATED AND AROMATIC HYDROCARBONS ON HEXADECANE METABOLISM BY SURFACE SLICK MICROORGANISMS
Crow, S. A., P. I. Bowman, and D. G. Ahearn. 1977.
American Society for Microbiology Annual Meeting, 77th,
New Orleans, 1977. Paper no. N92. Abstract.

Biodegradation, Hydrocarbons, Yeasts, Bacteria, Oil slicks,
Aromatic hydrocarbons, *Chlorinated hydrocarbons

Hydrocarbonoclastic bacteria were found to constitute less than 1.0% of the total heterotrophic bacteria isolated from estuarine surface slicks; however, over 90% of hexadecane was utilized in 48 hr in samples taken. Some chlorinated and aromatic hydrocarbons, which were found to accumulate from underlying waters in model hexadecane surface films, reduced hexadecane utilization by bacteria and yeasts. Observations suggest that the mode of action of these compounds on hexadecane metabolism may not be a simple mechanism and may differ from species to species.

C-2064-77
OPTIMIZATION STUDIES ON OIL SLUDGE DISPOSAL IN SOIL
Dibble, J. T., and R. Bartha. 1977.
American Society for Microbiology Annual Meeting, 77th,
New Orleans, 1977. Paper no. Q84. Abstract.

Biodegradation, Sludge, Soil, Disposal, Waste oil, Refineries

Parameters which affect the biodegradation of oil sludge in soil were studied in order to optimize this method for disposing of oil storage and refinery wastes. The greatest positive effect on the rate and extent of oil sludge degradation resulted from a combination of a slightly alkaline soil pH, a moderate loading rate of 10%, and a mesophilic temperature of 28°C. Using this combination, up to 35% of ether extractable hydrocarbons were biodegraded in 100 days.

C-2065-77
MICROBIAL DEGRADATION OF OIL SHALE
Findley, J. E., M. D. Appleman, and T. F. Yen. 1976.
Science and Technology of Oil Shale. T. F. Yen (ed.).
Michigan, Ann Arbor Science, 1976. p. 175-181.

Biodegradation, Oil shale, Bacteria, Hydrocarbons

"The oil shale was treated by bacteria, and the inorganic matrix was dissolved by the H_2SO_4 produced by the microorganisms. A 40% weight loss of the shale was obtained, and 98% of the dolomite and calcite were removed. Microorganisms capable of degrading hydrocarbons did affect the kerogen mols."

[from Chemical Abstracts 86(22):#158032x. 1977]

C-2066-77
BACTERIAL DEGRADATION OF HYDROCARBONS; I. TAXONOMIC STUDY OF THE BACTERIA WHICH ATTACK HYDROCARBONS [English summary]
Frieyro, O. 1975.
Sociedad Espanola de Historia Natural (Real), Boletin, Seccion Biologica 72:43-53.

Biodegradation, Hydrocarbons, Bacteria, *Taxonomy

Some techniques were developed for isolating hydrocarbon-metabolizing bacteria and, as a result, 40 bacterial strains from 9 different genera were isolated. This report is a systematic study of the bacteria, the types of hydrocarbons they biodegrade, and their capacity and rate of biodegradation.

C-2067-77
QUANTITATIVE STUDIES ON MARINE BIODEGRADATION OF OIL; II. EFFECT OF TEMPERATURE
Gibbs, C. F., K. B. Pugh, and A. R. Andrews. 1975.
Proceedings of the Royal Society of London 188(1090):83-94.

Biodegradation, Crude oil, Oxidation, Uptake, *Temperature effects

This paper examines the biodegradation of crude oil residues in seawater at different temperatures and with low concentrations of nitrogen and phosphorus. After studying oxygen uptake and nutrient absorption, it was suggested that the rate of breakdown of a low concentration of oil depends on the rate of oil and water mixing.

C-2068-77
BIODEGRADATION OF AROMATIC PETROLEUM HYDROCARBONS
Gibson, D. T. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 36-46. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Biodegradation, Aromatic hydrocarbons, Microorganisms, Sources

The following topics are discussed: origin of hydrocarbons in the environment; degradation of aromatic hydrocarbons by eucaryotic organisms; and degradation of aromatic hydrocarbons by procaryotic microorganisms.

C-2069-77
DEGRADATION OF MODEL RECALCITRANT HYDROCARBONS BY MICROORGANISMS FROM FRESHWATER ECOSYSTEMS
Griffin, W. M., and J. J. Cooney. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. RT37. Abstract.

Biodegradation, Hydrocarbons, Bacteria, Fungi, Freshwater, Sediments

Data are presented from a study examining the degradation of pristane and 1, 13-tetradecane by 22 bacteria and 15 fungi in freshwater and sediment cultures.

C-2070-77
CONTINUOUS OPEN FLOW-THROUGH SYSTEM AS A MODEL FOR OIL DEGRADATION IN THE ARCTIC OCEAN
Horowitz, A., and R. M. Atlas. 1977.
Applied and Environmental Microbiology 33(3):647-653.

Biodegradation, Oil slicks, Microorganisms, Arctic Ocean, *Continuous flow-through system

The microbial community underlying oil slicks increased and showed a population shift to a greater percentage of hydrocarbon-utilizing microorganisms. Microbial populations and oil biodegradation were increased by nitrogen and phosphorus addition. Chromatographic and spectrometric analyses showed that residual oils contained similar percentages of individual hydrocarbon components, regardless of the amount of degradation, indicating that most components were being degraded at similar rates.

C-2071-77
INTERACTIONS OF MICROORGANISMS AND HYDROCARBONS FOLLOWING AN ACCIDENTAL LEAKAGE OF GASOLINE INTO A FRESHWATER LAKE AT BARROW, ALASKA
Horowitz, A., and R. M. Atlas. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. Q82. Abstract.

Biodegradation, Hydrocarbons, Microorganisms, Gasoline, Lakes, Sediments, Alaska

After a 190,000 L (50,000 gal) leakage of gasoline into an arctic lake, changes in microbial communities in surface waters and sediments were monitored, and their ability to degrade hydrocarbons was determined in situ. Initially, the heterotrophic bacteria decreased in number, then increased to 10 times their original number. Their physical distribution paralleled the spread of gasoline contamination in the lake and sediments. About 99% of the hydrocarbons in the sediments were lost by natural weathering and biodegradation within 5 weeks.

C-2072-77
RESPONSE OF MICROORGANISMS TO AN ACCIDENTAL GASOLINE SPILLAGE IN AN ARCTIC FRESHWATER ECOSYSTEM
Horowitz, A., and R. M. Atlas. 1977.
Applied and Environmental Microbiology 33(6):1252-1258.

Biodegradation, Gasoline, Biological effects, Microorganisms, Lakes, Arctic

The effects on microorganisms of a 208,175 L (55,000 gal) spill of leaded gasoline into an arctic freshwater lake were studied. "Shifts in microbial populations were detected after the spillage, reflecting the migration pattern of the gasoline enrichment for hydrocarbon utilizers, and selection for leaded-gasoline-tolerant microorganisms... Nutrient addition and bacterial inoculation resulted in enhanced biodegradative losses, significantly reducing the amount of residual hydrocarbons."

C-2073-77
BACTERIAL DEGRADATION OF CRUDE OIL
Hughes, D. E., and S. Stafford. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd.,
1976. p. 39-46.

Biodegradation, Crude oil, Bacteria, Dispersants

A brief review with 40 references is presented on the microbial degradation of oil. Discussed are the relative rates of biodegradation, the types and numbers of microbial species that utilize oil, the numerous factors governing oil degradation, the effects of dispersants on bacteria, and results of field experiments.

C-2074-77
UTILIZATION OF AROMATIC HYDROCARBONS BY STRAINS OF *ACINETOBACTER*
Kunz, D. A., and P. J. Chapman. 1977.
American Society for Microbiology Annual Meeting, 77th,
New Orleans, 1977. Paper no. Q85. Abstract.
Biodegradation, Aromatic hydrocarbons, Bacteria, **Acinetobacter*

Aromatic hydrocarbon degradation by microorganisms can be attributed in part to their ability to elaborate enzymes of the catechol *ortho* and *meta*-fission pathways. Two distinct modes of substrate degradation which can be correlated with the enzymology of catabolic pathways used by *Acinetobacter* are detailed, based on patterns of hydrocarbon utilization, rates of oxidation by intact cells, and enzyme assays. Results show that members of the genus *Acinetobacter* exhibit varying abilities to elaborate enzymes of the catechol *meta*-fission route as is the case in genus *Pseudomonas*.

C-2075-77
MICROBIAL CONTRIBUTION TO WASTE OIL DECOMPOSITION IN SOIL IN AN ARID SITE
McDonald, S., and J. Skujins. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans,
1977. Paper no. Q46. Abstract.

Biodegradation, Waste oil, Soil, Monitoring, Bacteria, Fungi,
*Arid site

Microbial aspects of the degradation of oil under arid conditions were monitored for 3 years and correlated with biochemical changes in soil, disappearance of the oil, climate, addition of N, P, and Ca nutrients, and response in vegetation. Biodegradation was achieved primarily by greatly enlarged populations of lipolytic bacteria aided by some fungi; it occurred best under aerobic conditions, elevated temperatures, and availability of water and nitrogen. About 80% of the oil was degraded in 3 years, leaving a humus-like organic fraction in the soil.

C-2076-77
BIOTRANSFORMATION OF PETROLEUM HYDROCARBONS IN MARINE ORGANISMS INDIGENOUS TO THE ARCTIC AND SUBARCTIC
Malins, D. C. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 47-49. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Biodegradation, Marine organisms, Hydrocarbons, Arctic, Subarctic regions, Toxicity

A review is given of the recent literature dealing with the biotransformation of aromatic hydrocarbons in arctic and subarctic species. Deficiencies in the existing knowledge are assessed and the need for further studies is addressed.

C-2077-77
USE OF ^{14}C RADIOLABELLED HYDROCARBON SPIKED CRUDE OIL TO ASSESS OIL BIODEGRADATION POTENTIAL IN THE BEAUFORT SEA
Roubal, G., and R. M. Atlas. 1977.
American Society for Microbiology Annual Meeting, 77th, New Orleans, 1977. Paper no. Q83. Abstract.

Biodegradation, Hydrocarbons, Crude oil, Ice, Sediments, Seawater, Beaufort Sea

Ice, water, and sediment samples from the Beaufort Sea were collected in winter and in summer and incubated with Prudhoe crude oil spiked with ^{14}C radiolabelled hydrocarbons. Hydrocarbon biodegradation potentials in summer were found to be an unexpected 80% lower than biodegradation rates from comparable sediment and water samples taken in winter. Surface ice samples had biodegradation potentials that averaged 75% less than water and sediment samples.

C-2078-77
BIODEGRADATION OF EKOFISK OIL, AND THE EFFECTS OF WATER-SOLUBLE METABOLIC PRODUCTS ON THE FERTILIZATION AND DEVELOPMENT OF SEA URCHIN EGGS. [in Norwegian, occas. English]
NORDFORSK, Miljoevardssekretariatet, Publikation. (2, Organiska Miljoegifter i Vatten, Nordiska Symposiet om Vattenforskning, 12th):295-298.

Biodegradation, Crude oil, Toxicity, Echinoderms, *Ekofisk oil

Experiments show that biodegradation is not a suitable method for decontamination of sea water. Water-soluble toxic compounds were released and inhibited the fertilization and development of three species of sea urchins.

[from Chemical Abstracts 87(8):#57948r. 1977]

C-2079-77
MATERIAL FOR BIOLOGICAL DEGRADATION OF PETROLEUM
Townsley, P. M. 1976.
Canadian Patent 997,290.

Biodegradation, Oil spills, Patent, *Nutrient addition

Oil spill biodegradation in seawater is fostered by the addition of nutrient particles which have been treated so that they are lipophilic, hydrophobic, and float at the oil-water interface. The nutrient particles are coated with magnesium stearate which acts to release the nutrients slowly and also serves as a nutrient. The coated nutrient particles are dispersed over the oil spill by aerodusting or similar means.

[from Chemical Abstracts 86(26):#194681s. 1977]

C-2080-77
MODELING OF THE MICROBIAL OXIDATION OF PETROLEUM AND DIESEL FUEL [in Russian]
Tsuban, A. V., A. N. Zubekina, V. V. Il' inskii, S. P. Barinova, and T. O. Skakun. 1975.
Materialy Vsesoyuznogo Simpoziuma "Okeanograficheskie Aspekty Okhrany Vod ot Khimicheskikh Zagryaznenii," 1st, 1974. Chernyshov, V. I. (ed.). Moscow, USSR, Akademiya Nauk, SSSR, Okeanograficheskaya Komissiya, 1975. p. 191-194.

Biodegradation, Fuel oil, Petroleum products, Oxidation, Bacteria, Caspian Sea

The authors studied separate strains of hydrocarbon-oxidizing bacteria isolated from open waters of the Caspian Sea and from the mouth of the Lena River. The bacteria assimilated petroleum and diesel fuel and oxidized xylene.

[from Chemical Abstracts 87(8):#55314g. 1977]

C-2081-77
NUTRIENT LIMITATION OF OIL BIODEGRADATION IN LAKES OF VARYING WATER QUALITY IN VILAS COUNTY
Ward, D. M., and T. D. Brock. 1976.
Transactions of the Wisconsin Academy of Sciences, Arts and Letters No.64:240-249.

Biodegradation, Hydrocarbons, Bacteria, Lakes, Water quality, Wisconsin, *Nutrient limitation

The hydrocarbon oxidation potential of 25 lakes differing in nutrient content was studied. Oil-degrading bacteria generally comprised a small percentage of heterotrophic bacterial populations except in areas near boat landings where selective enrichment occurs. Rates of hydrocarbon oxidation were very low in all lakes but were stimulated by the addition of P and N nutrients.

[from Chemical Abstracts 86(26):#194831r. 1977]

C-2082-77
BIODEGRADABILITY OF NORTHERN CRUDE OILS
Westlake, D. W. S., and F. D. Cook. 1975.
Report ALUR 74-75-81. 21 p.

Biodegradation, Crude oil, Bacteria, Hydrocarbons, Soil, Canada, *Nutrient addition

Laboratory and field studies were conducted on the biodegradation of crude oils under northwestern Canadian conditions. Test plots were oiled and treated with fertilizer and/or oil-degrading bacteria. Fertilizers aided primarily in the microbial utilization of alkanes. The number of Clostridia was found to increase in the soil and water under oil spills.

[from Chemical Abstracts 87(1):#4621x. 1977]

2. PHYSICAL CHANGES OF OIL

C-2083-77
DETERMINATION OF THE SIZE DISTRIBUTION FUNCTION OF THE OIL PARTICLES DISPERSED IN SEAWATER ON THE BASIS OF MULTIFACTOR EXPERIMENT [English summary]
Akhmetov, A. Sh., V. I. Belyaev, and O. G. Mironov. 1976.
Dopovidi Akademii Nauk Ukrains'koi RSR, Ser. A No.8:705-707.

Distribution, *Oil particles, Seawater

"The size distribution function of the oil particles in seawater is logarithmically normal. In this contribution the parameters of distribution are determined as linear functions of the water temperature, time of mixing, energy dissipation and oil viscosity."

[from ERDA Energy Research Abstracts 2(11):#25909. 1977]

C-2084-77
THE STABILITY OF EMULSIFIED CRUDE OILS AS AFFECTED BY SUSPENDED PARTICLES
Huang, C. P., and H. A. Elliott. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 413-420. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Emulsions, Crude oil, Physical effects, *Suspended solids, *Stability

The primary objective of this research is to investigate the effect of various inorganic solids on the stability of crude oil emulsions. Interfacial reactions between emulsion and solid are influenced by the physical and chemical properties of both kinds of particles involved as well as the chemical characteristics of the aqueous phase.

C-2085-77
EVAPORATION AND SOLUTION OF C_2 TO C_{10} HYDROCARBONS FROM CRUDE OILS ON THE SEA SURFACE
McAuliffe, C. D. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 363-372. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Oil spills, Fate, Evaporation, Solution, Weathering

Evaporation and solution of C_2 to C_{10} hydrocarbons were measured from 4 ocean spills of 2 crude oils (24° and 39° API gravities). Experimental data are presented. These studies indicate that dissolution of hydrocarbons into the water column from crude oil slicks, followed by evaporation, resulted in immeasurably low concentrations (<1 μg/L) of dissolved C_2 to C_{10} hydrocarbons 15 min after each spill.

C-2086-77
SEA ICE TOPOGRAPHY IN THE BEAUFORT SEA AND ITS EFFECTS ON OIL CONTAINMENT
Wadhams, P. 1976.
AIDJEX Bulletin No.33:1-52.

Oil spills, Spreading, Ice, Beaufort Sea, *Under-ice spill

The topography of the Beaufort Sea ice cover was examined by airborne laser profiling methods and the data analyzed in order to give a quantitative description of pressure ridge and keel distributions. The distributions are used as a basis for a discussion of the extent to which sea ice deformation features help or hinder the long-term spreading of oil under ice after an under-ice blowout.

C-2087-77
MODELING OF OIL EVAPORATION IN AN AQUEOUS ENVIRONMENT. RESEARCH ON THE EFFECTS OF CRUDE OIL TRANSFER AND UPSTREAM REFINERIES ON DELAWARE BAY
Wang, H., W. C. Yang, and C. P. Huang. 1976.
Delaware University, College of Marine Studies report, CMS-RANN-5-76, NSF/RA-760478; Grant NSF-GI-41896. 49 p.

Oil spills, Models, Weathering, Evaporation, Oil transfer, Delaware Bay

The weathering of oil during early stages of a spill was investigated using computerized simulation of the evaporative changes in oil characteristics, specific gravity, and residues by weight and volume. The numerical results support laboratory findings which indicate that the effect of temperature on oil weathering is most significant at the early stages of weathering and diminishes with time. Wind speed has a more uniform effect throughout the time tested.

[from Government Reports Announcements 77(13):#PB-264 968/9GA. 1977]

3. CHEMICAL CHANGES OF OIL

C-2088-77
PHOTOOXIDATION OF N-HEXADECANE SENSITIZED BY XANTHONE
Gesser, H. D. 1977.
Environmental Science and Technology 11(6):605-608.

Models, Oil spills, Oxidation, Fate, *n-Hexadecane, *Photooxidation

"The photosensitized oxidation of hexadecane on water is studied as a model for the solar dissipation of oil spills." Experimental results are presented and discussed.

[from the UDS Water Quality Control Digest 8(4):III-30, #7F-28. 1977]

C-2089-77
FORMATION OF TOXIC PRODUCTS FROM A #2 FUEL OIL BY PHOTOOXIDATION
Larson, R. A., L. L. Hunt, and D. W. Blankenship. 1977.
Environmental Science and Technology 11(5):492-496.

Fuel oil, Toxicity, Yeasts, Oxidation, *UV irradiation

Simulated environmental levels of UV irradiation of a No. 2 fuel oil resulted in oxygenated compounds that were relatively soluble in water and toxic to baker's yeast. Maximum toxicity was reached within 24 hr and appeared to be due primarily to reactive peroxides. Addition of a mild reducing agent eliminated much of the light-induced toxicity. Continued irradiation produced other classes of compounds including phenols and carbonyls.

[from Chemical Abstracts 86(25):#184194w. 1977]

4. GENERAL FATE OF OIL

C-2090-77
SCIENTIFIC STUDY OF MAJOR OIL SPILL OFF THE UNITED STATES
Anon. 1977.
Petroleum Times 81(2049):76.

Argo Merchant spill, Monitoring, Environmental effects, Behavior, Movement, Sampling

The grounding of the Liberian tanker, "Argo Merchant," presented an opportunity for scientists to conduct studies on the properties, behavior, and detailed ecological impact of oil spills. A coordinated program of monitoring and tracking of the spill movement and behavior was provided by aircraft, while ground-based missions collected water, oil, and biological samples.

[from Petroleum Abstracts 17(28):#235,533. 1977]

C-2091-77
THE FATE OF PETROLEUM HYDROCARBONS FROM A NO. 2 FUEL OIL SPILL IN A SEMINATURAL ESTUARINE ENVIRONMENT
Bieri, R. H., and V. C. Stamoudis. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 332-344. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Fuel oil, Sediments, Marine organisms, Estuaries, Virginia

Experimental spills of No. 2 fuel oil were conducted in a York River, Virginia, estuarine area. The fate of oil components over time was investigated by repeated sampling of water sediments, oysters, and clams from the spill area and analysis by gas chromatography and computerized gas chromatography-mass spectrometry.

C-2092-77
DISTINCTIVE FEATURES OF THE SELF-PURIFICATION OF WATER AND BOTTOM DEPOSITS IN A SHALLOW SEA (AS EXEMPLIFIED BY THE SEA OF AZOV)
Bronfman, A. M., A. Ya. Aldakimova, G. D. Makarova, and L. I. Tolokonnikova. 1976.
Oceanology 16(1):48-51.

Petroleum products, Surfactants, Fate, Biodegradation, Seawater, Sediments, *Self-purification, *Sea of Azov

Spatial and seasonal variations in processes that rid seawater and bottom sediments of pollutant petroleum products and detergents are discussed with reference to studies conducted in the Sea of Azov. In a direction away from the coastal source of pollution, four distinct zones of self-purification occur, each with a characteristic assemblage of biological agents. The processes of self-purification in the pelagic and benthic zones of the sea are found to be out of phase and less effective than those of shallow waters; thus assuring a steady accumulation of toxic substances in bottom sediments.

C-2093-77
OIL SPILL FROM T/T "DRUPA": STUDIES ON THE OIL, WATER AND FISH [in Norwegian, occas. English]
Grahl-Nielsen, O., T. Neppelberg, K. H. Palmork, K. Westrheim, and S. Wilhelmsen. 1976.
NORDFORSK, Miljoevardssekretariatet Publikation (2, Organiska Miljoegilter i Vatten, Nordiska Symposiet om Vattenforskning, 12th):221-40.

Oil spills, Chemical analysis, Weathering, Biodegradation, Biological effects, Aromatic hydrocarbons, Fish, Norway, *T/T "Drupa" spill

Samples of spilled Iranian oil were collected along the Norwegian coast and analyzed by mass fragmentography. The authors estimated the effects of dissolution, emulsification, evaporation, microbial decomposition, and photochemical decay. Water samples were analyzed by gas chromatography and concentrations of aromatic hydrocarbons in fish liver were measured.

[from Chemical Abstract 87(8):#57947g. 1977]

C-2094-77
THE FATE OF OIL IN A MODEL ECOSYSTEM
Hagström, A. 1977.
Ambio 6(4):229-231.

Oil spills, Models, Fate, Biodegradation, Distribution, Baltic Sea, Intertidal zone

A model ecosystem representing the littoral zone of the Baltic Sea was developed for a simulation of the environmental effects of oil spills. Three different types of oil were used, namely, Nigerian crude and medium and light fuel oils. Changes in oil composition and distribution were monitored for 54 days, and bacterial degradation rates were measured. A theoretical model is presented which summarizes the events leading to the disappearance of oil in the sea.

C-2095-77
ALONG-SHORE COHERENCE OF WINDS ALONG THE NORTH ALASKAN COAST FOR OIL SPILL ANALYSIS
Hufford, G. L., J. P. Welsh, I. M. Lissauer, and B. D. Thompson. 1977.
Annual SPE of AIME Offshore Technology Conference, 9th, Houston, 1977. No. OTC-2947. p. 529-532.

Oil spills, Movement, *Coastal winds, Alaska

From analysis of available data, there appear to be 3 wind field regimes along the Alaskan North Slope coast: a western regime, a central regime, and an eastern regime. These regimes must be taken into account in the prediction of oil spill movement during normal conditions. During storm conditions, an existing Coast Guard storm model can be used to predict coastal winds.

[from Petroleum Abstracts 17(26):#235,037. 1977]

C-2096-77
SEA ICE THICKNESS PROFILING AND UNDER-ICE OIL ENTRAPMENT
Kovacs, A. 1977.
Annual SPE of AIME Offshore Technology Conference, 9th, Houston, 1977. No. OTC-2949. p. 547-554.

Oil spills, Fate, Ice, Alaska, *Oil-under-ice, *Impulse radar system

Results obtained with a unique dual-antenna impulse radar system used to profile first- and multi-year sea ice near Prudhoe Bay, Alaska, are discussed. A description of the radar system is given along with representative field data.

[from Petroleum Abstracts 17(26):#235,034. 1977]

C-2097-77
FATE AND EFFECTS OF NAPHTHALENES. CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Lee, R. F., and J. W. Anderson. 1977.
Bulletin of Marine Science 27(1):127-134.

Fate, Hydrocarbons, Seawater, Ecosystem, Sedimentation, Biodegradation, *Naphthalenes

The amount of naphthalenes which was present in the water of a controlled ecosystem pollution experiment was reduced by 50% one day after addition, and the concentrations gradually decreased to background levels during the following 20 days. Most of the decrease of naphthalenes was due to adsorption by sinking phytoplankton and microbial degradation. Microbial degradation of naphthalene at 5-10 m depth increased from 0.04 µg/L/day at day 0 to 3.3 µg/L/day after 3 days. An immediate decline in the ctenophore population of the systems was observed after addition of the naphthalenes.

C-2098-77
ENVIRONMENTAL RISK OF BEAUFORT SEA OIL SPILLS - A MANAGEMENT TOOL
Lissauer, I. M., J. P. Welsh, and G. L. Hufford. 1977.
Marine Technology Society Journal 11(1):22-25.

Oil spills, Movement, Shorelines, *Spill impact probability, Alaska Coast, Beaufort Sea.

Using available environmental data, this paper develops a technique for oil spill impact assessment of the north Alaskan coastline. Fifteen potential drilling sites are studied and a generalized equation is given for calculating minimum impact time for a spill to reach the shore. Probability of impact ranges from 40 to 96 percent.

C-2099-77
DISPERSAL AND ALTERATION OF OIL DISCHARGED ON A WATER SURFACE
McAuliffe, C. D. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 19-35. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Oil spills, Fate, Biological effects, Dispersants

The physical, chemical, and biological fate of oil discharged to a water surface is reviewed briefly, including recent literature. The only significant adverse effects from crude oil spills have been to birds and to some species of intertidal organisms where the oil stranded. Chemical dispersants have the potential for reducing the known adverse effects. This remedy is discussed, along with suggested research to evaluate effects from oil spills.

C-2100-77
ADSORPTION-DESORPTION OF SELECTED HYDROCARBONS IN CRUDE OIL ON SOILS
Nathwani, J. S., and C. R. Phillips. 1977.
Chemosphere 6(4):157-162.

Crude oil, Hydrocarbons, Soil, Adsorption, *Desorption, *Organic matter content

This study investigated the effects of hydrocarbon concentration, soil type, and organic matter content on the adsorption and desorption of selected petroleum hydrocarbons in soil. The organic matter content of soils is very important in both adsorption and desorption of crude oil constituents. The oil-sorbent capacity of soil was found to vary directly with organic matter content.

C-2101-77
HYDROCARBONS IN THE WATER COLUMN
Shaw, D. G. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 8-18. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Seawater, Fate, Marine organisms, *Molecular interactions

The molecular basis of the water-hydrocarbon interaction is reviewed from the perspective of the degree of aggregation of hydrocarbon molecules in water. Some of the ways in which this information can be used when considering the design and interpretation of experiments dealing with the fate and effects of petroleum on marine ecosystems and organisms are presented.

C-2102-77

UPTAKE AND RELEASE OF PETROLEUM BY INTERTIDAL SEDIMENTS AT PORT VALDEZ, ALASKA

Shaw, D. G., L. M. Cheek, and A. J. Paul. 1977.
Estuarine and Coastal Marine Science 5(3):429-436.

Uptake, Release, Hydrocarbons, Sediments, Oil slicks, Intertidal zone, Alaska

Two experiments were conducted which simulated the stranding of a light oil slick by spreading oil on sediments daily for 5 days. Hydrocarbon content of the top 1.0 cm of the sediments was monitored for 60 days. In both experiments, the added oil was no longer detectable on the 60th day. Possible reasons for the rapid loss of oil by sediments are discussed.

[from Petroleum Abstracts 17(31):#236,390. 1977]

C-2103-77

DETERMINATION OF THE LEEWAY OF OIL SLICKS

Smith, C. L. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 351-362. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Oil slicks, Movement, *Leeway, *Wind drift

The leeway of oil slicks was determined as a function of wind velocity in the range 5-25 kn to enable more precise forecasting of the trajectory of oil spills, and thus aid in effective containment and cleanup operations. Calculation of oil spill leeway is explained.

C-2104-77

A REVIEW AND EVALUATION OF BASIC TECHNIQUES FOR PREDICTING THE BEHAVIOR OF SURFACE OIL SLICKS

Stolzenbach, K. D., O. S. Madsen, E. E. Adams, A. M. Pollack, and C. K. Cooper. 1977.
Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Report No. 222. 315 p.

Oil slicks, Behavior, Physical effects, Models, *Wind-current effects

The purpose of the study is to conduct a state-of-the-art review of the basic techniques and knowledge associated with surface oil slick behavior. Results of this review are presented in the following manner : representation and determination of wind fields; treatment of the advection of oil slicks that is brought about by the combined action of currents and wind-waves; the physical phenomena that transform an oil slick as it is being advected; and a review and evaluation of existing models for oil slick behavior. A comprehensive bibliography is included at the end of the report.

C-2105-77
REMOVAL [OF OIL] BY NATURAL CAUSES
Wardley-Smith, J. 1976.
The Control of Oil Pollution on the Sea and Inland Waters.
J. Wardley-Smith (ed.). London, Graham & Trotman Ltd., 1976.
p. 27-38.

Fate, Contamination, Seawater, Spreading, Evaporation, Oxidation, Solution, Dispersions

Natural processes that remove oil contaminants on and in the sea are considered. These include spreading on water, evaporation, photochemical oxidation, and solution and the formation of dispersions in the water column.

C-2106-77
STUDIES ON THE OIL POLLUTION OF SEDIMENTS IN THE SETO INLAND SEA
Yamada, H., and M. Kayama. 1976.
Bulletin of the Nansei Regional Fisheries Research Laboratory
No. 9:19-31.

Petroleum products, Sediments, Movement, Japan, *Seto Inland Sea

The lipid content of the Seto Inland Sea is related to ignition loss. Organic compounds accumulate in the sediments of stagnant areas, and the n-alkanes/pristane and squalene ratio indicates the contributions from petroleum oil. The authors conclude that oil stranded at the southern coast of Harima Nada is moving toward the sediments of the stagnant area.

[from Aquatic Sciences & Fisheries Abstracts 7(7):#7Q8976. 1977]

C-2107-77
ROLE OF PHYSICOCHEMICAL AND MICROBIOLOGICAL FACTORS IN THE DEGRADATION OF HYDROCARBONS OF PETROLEUM ORIGIN [in Russian]
Zubakina, A. N., A. V. Tsyban, S. P. Barinova, and
I. M. Mikhalera. 1975.
Materialy Vsesoyuznogo Simpoziuma "Okeanograficheskie Aspecty Okhrany Vod Khimicheskikh Zagryaznenii," 1st, Moscow, 1974.
V. I. Chernyshov (ed.). Moscow, Akad. Nauk SSSR, Okeanograficheskie Komissiya, 1975. p. 66-72.

Decomposition, Fuel oil, Microorganisms, Biodegradation, *Physicochemical degradation

Microbial oxidation of fuel oil at -0.6° to 22° during 3-30 days was studied with special reference to conditions prevailing in the arctic region of the Pacific Ocean. At -0.3 to -0.6°, where physical and chemical degradation is greatly reduced, the bacterial oxidizing activity reduces the hydrocarbon content 38% at a microorganism count in seawater and ice of 10^4-10^5 colonies/ml. Oxidizing microorganisms degrade the fuel oil at the rate of 100-180 mg/l day, consuming 38-62% of the substrate in 6 days at 22° or 35% in 30 days at 2°. At this low temperature, only 1% is degraded by physical and chemical oxidation.

F. OIL POLLUTION REGULATIONS

1. U.S. LEGISLATION

C-2108-77
OIL POLLUTION LIABILITY (HEARINGS ON HR 9294, 10969, 10363, 10756 WHICH PROVIDE A COMPREHENSIVE SYSTEM OF LIABILITY FOR OIL SPILL DAMAGE AND CLEANUP COSTS)
Anon. 1976.
U.S. House of Representatives. Committee on Merchant Marine and Fisheries. Subcommittee on Coast Guard and Navigation. Hearings. October 29, November 4, 12, 18; December 2, 4, 16, 1975; January 29, 1976. Serial no. 94-21. 367 p.

Legislation, U.S., Oil spills, Liability, Compensation, Spill cleanup, *Costs

The proposed bills offer plans for comprehensive coverage for oil pollution damage, including a system of liability and compensation for spill damage and removal costs. This legislation proposes to establish a domestic oil pollution liability fund to provide protection for claimants not otherwise protected by previous conventions. It will provide for complete protection against damages to innocent third parties who will have ready access to compensatory funds.

[from Selected Water Resources Abstracts 10(13):#W77-06555. 1977]

C-2109-77
THE COAST: WHERE ENERGY MEETS THE ENVIRONMENT
Hildreth, R. G. 1976.
San Diego Law Review 13(2):253-305.

Legislation, U.S., OCS, Offshore development, Refineries, Environmental effects, Coasts

The adverse impacts of pollution from OCS development, onshore refineries, and chronic coastal oil pollution are some of the factors that in the long run could outweigh any short-term gains from exploitation of continental shelf resources. As coastal states stand to lose the most from such developments, the Deepwater Port Act and the Coastal Zone Management Act (CZMA) are assessed with the states' interest in mind.

[from Pollution Abstracts 17(29):#235,721. 1977]

C-2110-77
OIL TANKER SPILLS - WASHINGTON IS WEIGHING VARIOUS PREVENTIVE MEASURES
Scheibla, S. 1977.
Barrons Feb. 28:9.

Legislation, U.S., State governments, Oil spills, Tankers, Pollution control

Recent tanker-related spills are speeding up the enactment of state and federal legislation designed to prevent or abate oil discharges during tanker and ship operations. Laws being considered by Congress and some states are mentioned, and the effects of past and upcoming legislation upon Tennaco's Newport News dry dock and shipyard facility are assessed.

[from Environment Abstracts 7(5/6): #77-03184. 1977]

C-2111-77
REGULATION FOR TANK VESSELS ENGAGED IN THE CARRIAGE OF OIL IN DOMESTIC TRADE
U.S. Coast Guard. 1975.
Final Environmental Impact Statement, Report no. USCG-M-07-77. 335 p.

Oil transport, Tankers, U.S., Regulations, EIS, Pollution control, Oil discharges

Assessed is the environmental impact of proposed change to the pollution regulations in Title 33, Code of Federal Regulation, by adding conditions governing the design and operation of certain seagoing U.S. tank ships and barges certified to carry oil in U.S. domestic trade. The new regulations require segregated ballast on new tankers over 70,000 dwt, contain cargo tank size limits and improved tank vessel subdivision and stability, and set stringent discharge standards for both new and existing vessels requiring load-on-top or retention-on-board methods to curtail oil discharges to marine waters.

[from Government Reports Announcements 77(11):#AD-A036 719/3GA. 1977]

C-2112-77
REGULATIONS FOR U.S. TANK VESSELS CARRYING OIL IN FOREIGN TRADE AND FOREIGN TANK VESSELS THAT ENTER THE NAVIGABLE WATERS OF THE UNITED STATES
U.S. Coast Guard. 1976.
Final Environmental Impact Statement, Report no. USCG-M-08-77. 141 p.

Oil transport, Tankers, Segregated ballast, Regulations, U.S., EIS, Pollution control, Oil discharges

This statement assesses the environmental impact of changing the pollution prevention regulations in Title 33, Part 157, Code of Federal Regulations, to extend requirements for segregated ballast on new tankers over 70,000 dwt and other design equipment and operating requirements to the title groups of vessels. The purpose of these regulations is to control the discharge of oily mixtures from tank cleaning and deballasting operations and to incorporate construction requirements for new vessels which will reduce the occurrence of oil spills after accidents and improve the survivability of tankers after damage.

[from Government Reports Announcements 77(11):#AD-A036 769/8GA. 1977]

C-2113-77
RULES AND REGULATIONS FOR PROTECTION OF THE MARINE ENVIRONMENT RELATING TO TANK VESSELS CARRYING OIL IN DOMESTIC TRADE
U.S. Coast Guard. 1976.
Federal Register 41(5):1479-1482.

Regulations, Tankers, Segregated ballast, Environmental protection, USCG

These regulations provide for the placement of ballast tanks on oil-carrying vessels of over 70,000 dwt in order to minimize oil loss in the event of an accidental leakage from tankers. While some believe that the cost of segregated ballast is too high, the Coast Guard believes that it is needed to improve the environmental quality of the oceans.

[from Selected Water Resources Abstracts 10(15):#W77-07254. 1977]

C-2114-77
RULES FOR THE PROTECTION OF THE MARINE ENVIRONMENT RELATING TO TANK VESSELS CARRYING OIL IN BULK
U.S. Coast Guard. 1976.
Federal Register 41(240):54177-54180.

Regulations, Tankers, Oil discharges, Wastewaters, USCG

Amendments have been added to the oil vessel pollution regulations imposing design, equipment, and operation requirements for seagoing U.S. flag tank vessels of 150 gross tons or more and equally heavy foreign flag vessels that enter U.S. waters. The requirements are delineated in detail. The amendments also provide the conditions under which clean and segregated ballast may be discharged; they became effective April 1, 1977.

[from Selected Water Resources Abstracts 10(15):#W77-07251. 1977]

2. INTERNATIONAL LEGISLATION

C-2115-77
LEGAL ASPECTS OF MARINE POLLUTION CONTROL
Moore, G. 1976.
Marine Pollution. R. Johnston (ed.). London, Academic Press, 1976. p. 589-697.

International agreements, International conventions, Legislation, Pollution control, Oceans, UK, U.S.

In the first part of this chapter, customary international law, and international agreements and conventions concerning marine pollution, especially oil pollution, are examined. Recent trends toward comprehensive antipollution programs on the global and regional scale are discussed. The second part describes and summarizes national pollution control laws, programs, and approaches with numerous examples from the United Kingdom and the United States.

C-2116-77
INTERNATIONAL MARINE POLLUTION CONTROLS
Portmann, J. E. 1977.
Marine Pollution Bulletin 8(6):126-132.

International conventions, Legislation, Pollution control

"The purpose of this article is to attempt to bring some order to the international scene, by describing the aims, coverage, scientific validity and status of the main international pollution regulations, at least so far as they affect European marine interests." In the course of the paper, the author reviews the history of international oil pollution legislation, but the bulk of the article concerns other pollutants and conventions.

3. FOREIGN LEGISLATION

C-2117-77
ENVIRONMENTAL LEGISLATION - ALBERTA PETROLEUM EFFLUENT GUIDELINES (news brief)
Anon. 1977.
Water & Pollution Control 115(2):5.

Guidelines, Environmental protection, Refineries, Wastewater treatment, Canada, *Alberta

The Alberta Department of Environment and the petroleum refining industry have developed and reviewed wastewater effluent guidelines that will define minimum acceptable levels of wastewater treatment at refineries, consistent with good operating practices and environmental protection. Permits and licenses will now be issued only when these minimal requirements are met.

C-2118-77
ENVIRONMENTAL LEGISLATION - QUEBEC REFINERS TO MEET NEW EFFLUENT LEVELS (news brief)
Anon. 1977.
Water & Pollution Control 115(6):35.

Regulations, Wastewaters, Refineries, Environmental protection, Economics, Canada, *Quebec

Seven Quebec oil refineries will have to meet tough new effluent quality regulations by 1980. At present these refineries dump about 15,400 kg (34,000 lbs) of contaminants into the St. Lawrence River per day, of which about 3240 kg (7200 lbs) are oil and grease. Implementation of the regulations will cost the industry about $88 million.

C-2119-77
ENFORCEMENT OF OIL POLLUTION LEGISLATION
Brown, M. A. 1976.
The Modern Law Review 39(2):162-168.

Legislation, Law enforcement, Ships, Oil spills, England, Canada

The British oil pollution law is enforced only when there is substantial pollution or when the pollution, however minimal, is caused by substantial negligence. Pollution caused by foreign owned ships also poses serious legal problems. The author examines several methods utilized by the shipping community to pay for oil pollution damages. The Canadian law governing oil polluting incidents is also discussed.

[from Selected Water Resources Abstracts 10(13):#W77-06543. 1977]

4. STANDARDS AND GUIDELINES

C-2120-77
THE THREAT TO OUR SHORES
Bernstein, P. J. 1977.
Nation 224(3):73-77.

Regulations, Tankers, Ports, Government agencies, USCG, Safety, Law enforcement

U.S. Government agencies, especially the U.S. Coast Guard, are criticized for their failure to implement and enforce safety standards, such as double bottoms for all oil tankers entering U.S. ports. Unless such safety regulations are required in domestic and foreign registry tankers, a high number of oil spills off U.S. coasts are likely to continue.

[from Environment Abstracts 7(5/6):#77-03157. 1977]

C-2121-77
STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PETROLEUM REFINING INDUSTRY - 1975
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate. 1976.
Economic and technical review report, EPS 3-WP-76-11. 54 p.

Regulations, Pollution control, Wastewaters, Contaminants, Refineries, Canada

"Effluent regulations and guidelines to limit the discharge of pollutants from the petroleum refining industry were issued under the Federal Fisheries Act in November 1973. This report presents an assessment of the progress to the end of 1975 in meeting the discharge objectives, and provides projections of the anticipated status through to 1980."

[from Selected Water Resources Abstracts 10(15):#W77-07334. 1977]

C-2122-77
MANUAL ON OIL POLLUTION. SECTION 1 (PREVENTION). OCTOBER 1976.
Inter-Governmental Maritime Consultative Organization. 1976.
London, IMCO, 1976. 27 p.

Manuals, Pollution prevention, Guidelines, Tankers, Contingency planning

Section 1 of the Comprehensive Anti-Pollution Manual details practical information on means of prevention of oil pollution in the sea, especially useful to governments of developing countries. Requirements are given for all ships, with special details concerning tankers. Other sections of the manual address contingency planning, salvage, and methods of dealing with oil spills (published in 1972).

[from Aquatic Sciences & Fisheries Abstracts 7(7):#7Q9059. 1977]

5. AGREEMENTS AND CONVENTIONS

C-2123-77
AID TO THE BEWILDERED
Anon. 1977.
Ship & Boat International 30(5):35.

International conventions, Pollution prevention, EPA, IMCO, Sweden, *Baltic Convention

"Sweden has enacted legislation giving effect to the provisions of the Baltic Convention for the prevention of pollution of the seas." The Convention may serve as a model for similar action elsewhere regulating discharges into 'special waters.' This document differs slightly from the IMCO 1973 draft conventions, and both differ from the EPA regulations, as well as from local restrictions.

[from Aquatic Sciences & Fisheries Abstracts 7(8):7Q10559. 1977]

C-2124-77
NORTH SEA PACT SETS OIL POLLUTION LIABILITY
Anon. 1977.
Chemical and Engineering News 55 (January):15.

International agreements, Liability, Offshore drilling, Oil transfer, Storage, North Sea

An international agreement has been reached between countries adjoining the North Sea which assesses liability for pollution damage resulting from the escape of oil from offshore installations. The term installation covers any fixed or mobile unit involved in offshore oil activity, including platforms, pipelines, and oil transfer and storage structures. A liability of up to $35 million in damages can be assessed against the operator company, regardless of whether the company is at fault in a pollution incident or not.

C-2125-77
TOWARD A POLLUTION POLICY
Sandbrook, R. 1977.
Nature 267(5614):745-747.

International conventions, UN, Pollution control, Monitoring, Biological effects, Mediterranean Sea

The progress of a UNEP-sponsored international convention for preventing and controlling pollution in the Mediterranean is discussed. The program involves 16 of the 18 Mediterranean countries and includes provisions for extensive scientific research, monitoring, and integrated planning for the region. Included are regional baseline studies and monitoring of petroleum hydrocarbons, and studies on the effects of oil on marine organisms, populations, and marine communities and coastal ecosystems. Coastal transport of pollutants and water quality problems are also addressed.

C-2126-77
THE 1973 IMCO CONVENTION: TIGHTENING THE CONTROLS ON OPERATIONAL OIL POLLUTION FROM TANKERS
Skocypec, R. J. 1976.
UCLA-Alaska Law Review 5(2):353-380.

International conventions, IMCO, Oil discharges, Tankers, Law enforcement

The set of regulations proposed by the convention to control oil pollution from tankers includes an expanded definition of oil to cover various forms of petroleum, a strengthening of discharge standards, a new discharge monitoring and control system, shoreside treatment facilities, and segregated ballast tanks for new vessels exceeding 70,000 dwt. The major drawback of the new regulations is in enforcement.

[from Selected Water Resources Abstracts 10(15):#W77-07244. 1977]

G. BIBLIOGRAPHIES

C-2127-77
EFFECTS OF POLLUTION ON FRESHWATER FISH
Brungs, W. A., J. H. McCormick, T. W. Neiheisel, R. L. Spehar, C. E. Stephan, G. N. Stokes. 1977.
Journal Water Pollution Control Federation 49(6):1425-1493.

Bibliographies, Fish, Freshwater, Biological effects

This bibliographic review covers symposia and reviews, topics on water quality and various pollutants including pesticides, domestic, industrial, radioactive, and other pollutants. There are 464 references cited with nine concerning oil pollution.

C-2128-77
THE BIOLOGICAL EFFECTS OF OIL SPILLS (A BIBLIOGRAPHY WITH ABSTRACTS)
Harrison, E. A. 1977.
Report for 1964-March 1977. 196 p.

Bibliographies, Oil spills, Biological effects, Plants, Animals, Microorganisms

This bibliography contains 191 abstracts, 49 of which are new entries to the previous edition, which cover the biological and ecological effects of oil spills in salt and fresh water. The effects on microorganisms, plants, and animals are studied, along with research on the residues and metabolic products of various oil components.

[from Government Reports Announcements 77(11):#NTIS/PS-77/0200/4GA. 1977]

C-2129-77
OIL SHALE MINING, PROCESSING, USES,AND ENVIRONMENTAL IMPACTS. VOLUME 1. 1970-1975 (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Hundemann, A. S. 1977.
Report for 1970-1975. 219 p.

Bibliographies, Oil shale, Development, Extraction, Environmental effects

Research projects on the mining, extraction, environmental impacts, and other topics related to oil shale development are covered. The report contains 212 citations with abstracts.

[from Government Reports Announcements 77(14):#NTIS/PS-77/0386/1GA. 1977]

C-2130-77
OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS. VOLUME 2. 1976-APRIL 1977 (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Hundemann, A. S. 1977.
Report for 1976-1977. 138 p.

Bibliographies, Oil shale, Development, Extraction, Environmental effects

Research projects on the mining, extraction, environmental impacts, and other topics related to oil shale development are covered. The report contains 131 citations with abstracts, 112 of which are new entries to the previous edition.

[from Government Reports Announcements 77(14):#NTIS/PS-77/0387/9GA. 1977]

C-2131-77
OIL SHALE MINING, PROCESSING, USES,AND ENVIRONMENTAL IMPACTS. VOLUME 1. 1964-1975. (CITATIONS FROM THE NTIS DATA BASE)
Hundemann, A. S. 1977.
Report for 1964-1975. 200 p.

Bibliographies, Oil shale, Development, Extraction, Environmental effects, Pollution control

Government-funded studies on oil shale are covered, including topics on environmental impacts and air and water pollution control. The report contains 195 citations with abstracts.

[from Government Reports Announcements 77(14):#NTIS/PS-77/0384/6GA. 1977]

C-2132-77
OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS. VOLUME 2. 1976-APRIL 1977 (CITATIONS FROM THE NTIS DATA BASE)
Hundemann, A. S. 1977.
Report for 1976-April 1977. 153 p.

Bibliographies, Oil shale, Development, Extraction, Environmental effects, Pollution control

Government-funded research projects on oil shale are covered, including reports on environmental impacts and air and water pollution control. The report contains 148 citations with abstracts 120 of which are new entries to the previous edition.

[from Government Reports Announcements 77(14):#NTIS/PS-77/0385/3GA. 1977]

C-2133-77
MARINE AND ESTUARINE POLLUTION
Reish, D. J., T. J. Kauwling, A. J. Mearns, P. S. Oshida, and S. S. Rossi. 1977.
Journal Water Pollution Control Federation 49(6):1316-1340.

Bibliographies, Estuaries, Marine organisms, Environmental effects

This bibliographic review covers residues, sludge, dumping and dredging, diseases and abnormalities, complex effluents and environments, oil pollution, microorganisms, and physical and chemical aspects of marine pollution. There are 312 references in all, with 104 on oil pollution.

C-2134-77
INTERNATIONAL AND MARINE POLLUTION
Smith, J. O. and J. L. Jackson. 1977.
Journal Water Pollution Control Federation 49(6):1547-1553.

Bibliographies, Legislation, U.S., Pollution control

The authors review federal and state water pollution control and litigation, as well as sources of water pollution. Eighty references are given, thirty-one of which are court cases, and fourteen referring to oil pollution.

C-2135-77
OIL POLLUTION DETECTION AND SENSING (A BIBLIOGRAPHY WITH ABSTRACTS)
Smith, M. F.. 1976.
NTIS, Report for 1964-July 1976. 239 p.

Bibliographies, Detection, Sampling, Monitoring, Chemical analysis, Remote sensing

This updated bibliography contains 58 new entries to the previous edition, with a total of 234 abstracts. Most of the report deals with oil spills, although research on oil detection in industrial wastes and sewage is also cited. Analytical techniques include chromatography, infrared spectroscopy, light scattering, fluorescence, mass spectroscopy, and remote sensing. Oil and hydrocarbon sampling, monitoring, and instrumentation are covered.

[from ERDA ENergy Research Abstracts 2(14):#33937. 1977]

C-2136-77
SELECTED REGIONAL BIBLIOGRAPHY ON MARINE POLLUTION [IOC/FAO/UNEP INTERNATIONAL WORKSHOP ON MARINE POLLUTION IN THE CARIBBEAN AND ADJACENT REGIONS, TRINIDAD, 1976]
Thomas, S. J., and D. S. Moulder. 1976.
Paris, Intergovernmental Oceanographic Commission. 1976. 59 p.
IOC-FAO-UNEP-IWMPCAR--17.

Bibliographies, Contamination, Caribbean Sea, Marine organisms

The bibliography contains 498 references on pollution in marine and brackish waters of the Caribbean and adjacent regions. References are arranged in 13 sections, mainly by pollutant.

[from Aquatic Sciences & Fisheries Abstracts 7(6):#7Q7429. 1977]

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information and a summary of project objectives are provided in each entry. Project notices have been obtained from the Smithsonian Science Information Exchange (SSIE). Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered by serial number within each subject division. The serial number designates the original issue of OIL SPILL AND OIL POLLUTION REPORTS in which the research project is listed:

R-001-74 to R-165-74	EPA-670/2-75-003 July 74 to October 74
R-269-74 to R-342-74	EPA-600/2-76-129 May 75 to July 75
R-269-75 to R-304-75	EPA-600/2-76-113 August 75 to October 75
R-124-76 to R-175-76	EPA-600/2-77-037 August 76 to October 76
R-001-77 to R-022-77	EPA-600/2-77-075 November 76 to January 77
R-076-77 to R-096-77	August 77 to October 77

A. OIL POLLUTION DETECTION AND EVALUATION

1. MONITORING

R-002-77 (renewal)
SOUTHERN CALIFORNIA BORDERLAND - ENVIRONMENTAL

Principal Investigator:	Greene, H.G.
Performing Organization:	U.S. Department of the Interior, Geological Survey, 345 Middlefield Rd. Menlo Park, CA 94025
Supporting Agency:	U.S. Department of the Interior, Geological Survey, Geologic Division, No. 9460-01650
Period:	10/76 to 9/77
Funds:	$142,000

A study is being conducted to identify, map, and report the geologic hazards and problems that exist in the southern California borderland, specifically in areas where future development may take place. Geological hazards consist of faults, submarine landslides and slumps, hydrocarbon seeps, salt water intrusion sites, contaminant pathways, and areas of anomalous high erosion and sedimentation. Areas to be looked at include the central part of Santa Rosa-Cortes Ridge, San Diego shelf, western Santa Barbara Channel, and miscellaneous OCS areas that lie in water depths shallower than 750 m.

[SSIE No. ZUA-3979-1]

R-076-77
ENVIRONMENTAL SUPPORT TECHNOLOGY - TRACE GASES IN THE MARINE ENVIRONMENT

Principal Investigators:	Swinnerton, J.W., and W.D. Smith
Performing Organizations:	U.S. Navy, Research Laboratory, Washington, D.C. 20375
Supporting Agency:	U.S. Department of Defense, Navy, No. DN620141
Period:	10/76 to 9/77

The objectives of this project are "to develop and utilize shipboard and in situ methods for measuring the concentrations of gases and hydrocarbons in ocean and atmosphere in order to better assess pollution in the marine environment, to minimize underwater corrosion and to determine the relationships of dissolved gases to marine biota."

[SSIE No. ZQN-620141-3]

2. SAMPLING

R-077-77
NEW APPROACHES TO THE PRESERVATION OF CONTAMINANTS IN WATER SAMPLES

Principal Investigator:	Saxena, J.
Performing Organization:	Syracuse University Res. Corp., Merrill Lane, University Heights, Syracuse, NY 13210
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development, No. R80460901
Period:	9/76 to 8/77
Funds:	$32,410

This project will test new methods of water sample preservation. Nitrogen and phosphorus series, oil, grease, and organic carbon are the sample parameters that will be stabilized. Four phases of study will encompass the following: 1) evaluation of the effectiveness of the proposed preservation methods in controlling microorganisms; 2) study of the stability of the contaminants in natural waters; 3) study of the effects of storage and transportation parameters on the preservation methods; and 4) simplification of the methods for field application, cost benefit analysis, and comparisons with currently used methods.

[SSIE No. GMA-3256]

3. ANALYSIS

R-022-77 (renewal)
COASTAL SEDIMENTOLOGY

Principal Investigator:	Clifton, H.E.
Performing Organization:	U.S. Department of the Interior, Geological Survey, 345 Middlefield Rd., Menlo Park, CA 94025
Supporting Agency:	U.S. Department of the Interior, Geological Survey, Geological Division, No. 9460-00984
Period:	10/76 to 9/77
Funds:	$292,000

Included in the project are facies analysis of estuarine deposits; a study of sand transport in the estuarine system of Willapa Bay, Washington; studies of the hydrodynamic effects of waves on sedimentation and the mechanics of beach sedimentation;

research on the distribution of spilled oil in nearshore systems and the physical and chemical changes in oil attendant with beach and nearshore processes; and studies of nearshore sedimentation of the coast of Alaska and the effect of storm surges. The results of coastal reconnaisance of the Bering Sea from the previous year will be analyzed and compiled for publication.

[SSIE No. ZUA-2471-4]

R-078-77
CHEMISTRY OF AQUATIC ORGANIC MATTER

Principal Investigator:	Goerlitz, D.F.
Performing Organization:	U.S. Department of the Interior, Geological Survey, 345 Middlefield Rd., Menlo Park, CA 94025
Supporting Agency:	U.S. Department of the Interior, Geological Survey, Water Resources Division, No. WR 00-149
Period:	7/75 to 9/76
Funds:	$75,037

This investigation will involve: identification of organic substances brought about by introduction of selected pollutants into the environment; laboratory determination of the equilibrium and kinetics of reactions within the aquatic system and those that occur at the water-mineral interface; and application of the above relationships to the field behavior of the organics.

[SSIE No. ZUA-4131]

R-079-77
NAVY ENVIRONMENT: CHARACTERISTICS AND STABILITY OF COLLOIDAL MATERIAL ACCOMMODATING HYDROCARBONS IN THE OPEN OCEAN

Principal Investigator:	Zsolnay, A.
Performing Organization:	Bermuda Biological Station for Research, St. Georges, St. Georges West, Bermuda
Supporting Agency:	U.S. Department of Defense, Navy, No. DN675124, Contract N00014-76-C-0029
Period:	10/76 to 9/77
Funds:	$39,948

This project will study the contributions of organic compounds to the characterization of chemical and biological properties of seawater, their role as an energy source for the benthic community, and their effect on sediment physicochemical properties. The mechanism of transport of this material is emphasized. Seawater samples will be collected from the Sargasso Sea for fractionation of colloids and subsequent removal and chemical analysis of sorbed hydrocarbons.

[SSIE No. GQN-675124]

4. SOURCE IDENTIFICATION

R-124-76 (renewal)
LIGHT HYDROCARBONS - OCS
Principal Investigator: Cline, J.D.
Performing Organization: U.S. Department of Commerce, Environmental Research Laboratories, Boulder, CO 80302
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Research Laboratories, No. R7120841
Period: 10/76 to 9/77
Funds: $65,000

The current objective is to determine the nature of sedimentary hydrocarbon sources in the Tarr Bank - Kayak Island region of the northeast Gulf of Alaska. Seep locations on the Kodiak Shelf are also being identified. All previous survey work on the distribution of low molecular weight hydrocarbons on the Alaskan OCS has been completed and is being compiled for reports.

[SSIE No. GUK-65-2]

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

R-080-77
STRENGTH AND SEAKEEPING ABILITY OF POLLUTION CONTROL BARRIERS

Principal Investigator:	Unknown
Performing Organization:	Marine Professional Services, Cambridge, MA 02138
Supporting Agency:	U.S. Department of Transportation, Office of the Secretary, No. CG59182, Contract CG-61, 803-A
Period:	2/76 to 5/76

"The objective is to determine all the commercially available barriers suitable as candidates for controlling oil in high seas applications including a sea state three or greater."

[SSIE No. GZO-256]

2. OIL TRANSFER AND TRANSPORT

R-081-77
MODIFICATIONS TO FUEL AND BALLAST SYSTEM, R/V ROBERT D. CONRAD

Principal Investigator:	Talwani, M.
Performing Organization:	Columbia University, Lamont Doherty Geolog. Observ., Palisades, NY 10964
Supporting Agency:	U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-20520
Period:	1/77 to 12/77
Funds:	$129,800

Funds will be used to support modifications on this research vessel to end the overboard discharging of oily ballast water during refueling operations.

[SSIE No. CM-285]

3. WASTE TREATMENT AND DISPOSAL METHODS

R-082-77

POWDERED CARBON - ACTIVATED SLUDGE - FILTRATION PROCESSES FOR PETROLEUM REFINERY WASTEWATER

Principal Investigator: Knecht, A.T.
Performing Organization: Atlantic Richfield Company, 400 E. Sibley Blvd., Harvey, IL 60426
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development, No. R804731 01
Period: 1/77 to 12/77
Funds: $200,000

The objective of this project is "to determine if direct addition of powdered activated carbon (PAC) to activated sludge units and changes in operating procedures will significantly improve effluent quality and approach Best Available Technology." The role of adsorbents in enhancing biological treatment will be studied, as well as the ultimate fate of sludges disposed by land application.

[SSIE No. GMA-3469]

R-083-77

SORPTION OF RESIDUAL ORGANIC SUBSTANCES IN RETORT WATERS BY SPENT OIL SHALE RESIDUES

Principal Investigator: Leenheer, J.A.
Performing Organization: U.S. Department of the Interior, Geological Survey, Denver, CO 80225
Supporting Agency: U.S. Department of the Interior, Geological Survey, Water Resources Division, No. CR 00-181
Period: 7/75 to 9/76
Funds: $79,498

The disposal of waste retort water from oil-shale processes onto spent oil-shale residues may result in leaching of organic solutes into ground water or run off into surface water. At present there are no recommendations concerning the disposal capacity of spent oil shale organic substances in retort waters. "A preliminary objective [of this report] will be to develop an organic water quality analytical program such that background concentrations of dissolved and sediment organic materials can be determined and characterized for surface and ground water in regions of oil-shale and coal development. The overall objective is to determine the capacity of spent oil-shale residues to adsorb and immobilize residual organic substances in retort waters."

[SSIE No. BI-76-1]

R-084-77

CHEMICAL DEMULSIFIERS SUITABLE FOR LARGE SCALE USE IN SHORE-BASED OILY WASTE TREATMENT PLANTS

Principal Investigator: Little, R.C.
Performing Organization: U.S. Navy, Research Laboratory, Washington, D.C. 20375
Supporting Agency: U.S. Department of Defense, Navy, No. DN580173
Period: 10/76 to 9/77

Non-specific chemical agents for breaking emulsions in Navy bilge waste collection and treatment systems and in the new oily waste treatment plant facilities are being developed and evaluated. These agents will be tested and used under practical working conditions.

[SSIE No. ZQN-580173]

Status: The project has been completed.

Reports and Publications

BREAKING EMULSIONS IN NAVY BILGE COLLECTION AND TREATMENT SYSTEMS
Little, R.C., and R.L. Patterson. 1976.
NRL Memorandum Report 3424.

BREAKING EMULSIONS IN NAVY BILGE COLLECTION AND TREATMENT SYSTEMS
Little, R.C., and R.L. Patterson. 1977.
Submitted to Environmental Science and Technology.

EMULSIFIER AND SURFACE EFFECTS OBSERVED IN LABORATORY FILTER COASLESCER STUDIES OF OIL-WATER SEPARATION
Zakin, J., and R.C. Little. 1977.
Submitted to Environmental Science and Technology.

Information Source: R.C. Little, Surface Chemistry Branch,
Naval Research Laboratory, Washington, D.C.20375

4. PREVENTION AND CONTROL MEASURES

R-085-77
NAVY ENVIRONMENT: INFORMATION SYSTEM FOR MANAGEMENT OF ENVIRONMENTAL PROTECTION RESEARCH PROGRAM
Principal Investigator: Hnat, K.
Performing Organization: Telcom Incorporated, 2300 S. 9th St., Arlington, VA 22204
Supporting Agency: U.S. Department of Defense, Navy, No. DN575373, Contract N00014-75-C-0988
Period: 10/76 to 9/77
Funds: $24,912

This project will develop the information system mentioned in the title with special emphasis on pollution control guidelines. Investigations will be made of current ship pollution control programs and will identify revisions to regulatory and funding requirements.

[SSIE No. GQN-575373-1]

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

R-101-74 (renewal)
MARINE PETROLEUM POLLUTION - BIOLOGICAL EFFECTS AND CHEMICAL CHARACTERIZATION

Principal Investigators:	Parker, P.L., J.A. Nicol, and C. VanBaalen
Performing Organization:	University of Texas, Marine Science Institution, Port Aransas, TX 78373
Supporting Agency:	U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-83913
Period:	2/77 to 7/78
Funds:	$71,900

"The overall goal of this final year is to evaluate the significance of demonstrated toxicity by chemically characterized compounds. This will provide, as a guideline for environmental management, the levels of petroleum types which might be safe in the ocean for a variety of marine plants and animals."

[SSIE No. GSN-1146-4]

R-109-74 (renewal)
FATE, SPATIAL AND TEMPORAL DISTRIBUTION OF PETROLEUM DERIVED ORGANIC COMPOUNDS IN THE OCEAN AND THEIR SUBLETHAL EFFECTS ON MARINE ORGANISMS

Principal Investigator:	Sackett, W.M.
Performing Organization:	Texas A & M University System, School of Geosciences, College Station, TX 77843
Supporting Agency:	U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-81493
Period:	2/77 to 7/78
Funds:	$28,200

Environmental concentrations of C5 to C12 hydrocarbons in the Gulf of Mexico will be established, and the levels of these hydrocarbons necessary to inhibit primary producers in laboratory experiments will be confirmed. Prior research in this project has shown that C5-C12 straight chain hydrocarbons are more toxic to phytoplankton than aromatics such as benzene and toluene, a result contrary to previous beliefs.

[SSIE No. GSN-1145-4]

Reports and Publications

THE FLUX OF LIGHT HYDROCARBONS INTO THE GULF OF MEXICO VIA RUNOFF
Brooks, J.M. 1977.
Marine Pollutant Transfer. H.L. Windom, and R.A. Duce (eds.).
Lexington, MA, Lexington Books, D.C. Heath and Company, 1977.
p. 185-200.

Light gaseous hydrocarbons (methane through pentanes) are sensitive indicators of petroleum pollution. Natural processes cannot account for the occurrence of light hydrocarbons in the Gulf of Mexico, and thus they must enter chiefly from man-derived sources, river runoff, and/or across the sea/air or sea/sediment interface. In particular, light hydrocarbons in the Mississippi River originate predominantly from petroleum and petrochemical activities. Significant impacts on coastal waters are evidenced by hydrocarbon anomalies seen from 16-32 km (10-20 mi) off port and up to 80 km (50 mi) off the Mississippi River.

GULF UNDERWATER FLARE EXPERIMENT (GUFEX): EFFECTS OF HYDROCARBONS ON PHYTOPLANKTON
Brooks, J.M., G.A. Fryxell, D.F. Reid, and W.M. Sackett.
Marine Biological Effects of Petroleum Hydrocarbons.
C.S. Giam (ed.). D.C. Heath and Co. In press.

"Carbon-14 uptake, plant pigments, ATP and POC concentrations, the ratio of full to empty cells and species of phytoplankters and standard hydrographic parameters were determined as a function of hydrocarbon concentrations in the vicinity of underwater 'flaring', the venting of non-commercial quantities of natural gases separated from liquid petroleum on offshore petroleum production platforms. Although there were significant covariances between hydrocarbon concentrations and several biomass parameters, the variability was apparently due to upwelling, induced by the rapidly rising jet of gaseous hydrocarbons."

SIGNIFICANCE OF LOW-MOLECULAR-WEIGHT HYDROCARBONS IN MARINE WATERS
Brooks, J.M., and W.M. Sackett. 1977.
Proceedings of the 7th International Meeting on Organic Geochemistry, 1975. R. Campos and J. Gon (eds.).
Madrid, Revista Espanola de Micropaleon., 1977. p. 455-468.

Thousands of determinations of dissolved hydrocarbons in surface water for 5000 miles of cruise tracks in the Gulf of Mexico have been made using a shipboard "sniffer" system. Surface water analyses show up to 6 orders of magnitude higher levels of C_1 to C_5 saturated hydrocarbons than open ocean surface water. In almost all cases these high concentrations are attributable to petroleum production operations as many as 10 miles distant, suggesting that saturated low-molecular-weight hydrocarbons are very sensitive indicators of man-derived petroleum pollution.

Information Source: W.M. Sackett, Texas A & M University, College of Geosciences, College Station, TX 77843

R-086-77
LONG-TERM EFFECTS OF HYDROCARBONS ON SELECTED ECOSYSTEMS AND ASSOCIATED ORGANISMS

Principal Investigators:	Anderson, J.W., and R.M. Bean
Performing Organization:	Battelle Memorial Institute, P.O. Box 999, Richland, WA 99352
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development, Contract EPA-IAG-D6-E681-CF
Period:	7/75 to 6/76
Funds:	$313,000

The main objective of this project is to determine the effects of long-term, low-level petroleum hydrocarbon (PHC) contaminated water on the growth and reproduction of two sensitive crustaceans (amphipods and mysids) exposed for more than one generation. Research will cover exchange of specific PHCs between oil, sediment, water, and organisms from laboratory and field experiments; availability of sediment-sorbed PHCs to deposit-feeding organisms; and alteration of PHCs in and on oiled sediments and the effect of this alteration on recruitment of benthic organisms.

[SSIE No. GMA-2990]

Status: This is a large program involving both biology and analytical chemistry. It is funded through 1978.

Reports and Publications

RESPONSES TO SUBLETHAL LEVELS OF PETROLEUM HYDROCARBONS: ARE THEY SENSITIVE INDICATORS AND DO THEY CORRELATE WITH TISSUE CONTAMINATION?
Anderson, J.W. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 95-114. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

EFFECTS OF PETROLEUM HYDROCARBONS ON THE RATE OF HEART BEAT AND HATCHING SUCCESS OF ESTUARINE FISH EMBRYOS
Anderson, J.W., D.B. Dixit, G.S. Ward, and R.S. Foster, 1977.
A. Calabrese and F.P. Thurberg (eds.). New York, Academic Press, 1977. p. 241-258.

BIOAVAILABILITY OF SEDIMENT-SORBED NAPHTHALENES TO THE SIPUNCULID WORM, *PHASCOLOSOMA AGASSIZII*
Anderson, J.W., L.J. Moore, J.W. Blaylock, D.L. Woodruff, and S.L. Kiesser. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 276-285. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

RECRUITMENT OF BENTHIC ANIMALS AS A FUNCTION OF PETROLEUM HYDROCARBON CONCENTRATIONS IN THE SEDIMENT
Anderson, J.W., R.G. Riley, and R.M. Bean. 1978.
International Symposium on "Recovery of Oiled Northern Marine Environments", Nova Scotia, October, 1977. In press.

LABORATORY AND FIELD STUDIES ON THE EFFECTS OF PETROLEUM HYDROCARBONS ON BENTHIC MARINE INVERTEBRATES
Anderson, J.W., R.G. Riley, R.M. Bean, J.W. Blaylock, and S.L. Kiesser. 1977.
Proceedings of EPA Workshop on the Interagency Marine Research Program Associated with Energy Development, Newport, Rhode Island, March 1-3, 1977. In press.

OIL BIOASSAYS WITH THE AMERICAN OYSTER, *CRASSOSTREA VIRGINICA* (GMELIN)
Anderson, R.D., and J.W. Anderson. 1976.
Proceedings of the National Shellfisheries Association 65:38-42.

DISTRIBUTION OF NAPHTHALENES WITHIN EXPOSED *FUNDULUS SIMILUS* AND CORRELATIONS WITH STRESS BEHAVIOR
Dixit, D., and J.W. Anderson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup). Washington, D.C., American Petroleum Institute, 1977. p. 633-636. Held in New Orleans, March 8-10, 1977.

EFFECTS OF WATER-SOLUBLE FRACTIONS OF NO. 2 FUEL OIL ON THE DEVELOPMENT OF THE FISH *FUNDULUS SIMILUS*
Ernst, V., J.M. Neff, and J.W. Anderson. 1977.
Environmental Pollution. In press.

FATE AND EFFECT OF NAPHTHALENES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Lee, R.F., and J.W. Anderson. 1977.
Bulletin of Marine Science 27:127-134.

EFFECTS OF PETROLEUM ON SURVIVAL, RESPIRATION AND GROWTH OF MARINE ANIMALS
Neff, J.M., J.W. Anderson, B.A. Cox, R.B. Laughlin, Jr., S.S. Rossi, and H.E. Tatem. 1976.
Sources, Effects and Sinks of Hydrocarbons in the Aquatic Environment. Arlington, Virginia, American Institute of Biological Sciences, 1976. p. 515-539. Proceedings of the Symposium, Washington, D.C., 9-11 August, 1976.

ACCUMULATION AND RELEASE OF PETROLEUM-DERIVED AROMATIC HYDROCARBONS BY FOUR SPECIES OF MARINE ANIMALS
Neff, J.M., B.A. Cox, D. Dixit, and J.W. Anderson. 1976.
Marine Biology 38:279-289.

ACCUMULATION AND RELEASE OF FUEL OIL DERIVED DIAROMATIC HYDROCARBONS BY THE POLYCHAETE, NEANTHES ARENACEODENTATA (MOORE)
Rossi, S.S., and J.W. Anderson. 1977.
Marine Biology 39:51-55

TEMPERATURE, SALINITY AND OIL EFFECTS ON THE INGESTION, EGESTION AND GROWTH OF NEANTHES ARENACEODENTATA (MOORE)
Young, L., and J.W. Anderson. 1976.
American Zoology 16:238. Abstract.

Information Source: J.W. Anderson, Senior Research Scientist,
Battelle Pacific Northwest Division,
Marine Research Laboratory, Route 5,
Box 100, Sequim, WA 93832

R-087-77
ACUTE FISH BIOASSAY

Principal Investigator:	Slonim, A.R.
Performing Organization:	U.S. Air Force, Aerospace Medical Research Laboratory, Wright Patterson A.F.B. Dayton, OH 45433
Supporting Agency:	U.S. Department of Defense, Air Force, No. DF320510
Period:	10/76 to 9/77

This project will determine the water pollution potential of aircraft fuels and lubricants, missile propellants and their exhaust products, and other Air Force materials that could result in significant environmental damage. The acute toxicity of hydrazine, UDMH, aerozine-50, and MMH will be determined using propellant bioassays with the fathead minnow and other fish species. The efficacy of various chemicals will be evaluated relative to reversing or reducing the toxicity to fish life. Results will provide a data base upon which environmental impact statements and assessments can be made as they apply to weapon systems using these chemicals.

[SSIE No. ZQF-320510]

R-088-77
ECOLOGICAL, PHYSIOLOGICAL, AND TOXICOLOGICAL EFFECTS OF OIL ON BIRDS

Principal Investigator: Stickel, L.F.
Performing Organization: U.S. Department of the Interior, Fish and Wildlife Service, Laurel, MD 20811
Supporting Agency: U.S. Department of the Interior, Fish and Wildlife Service, Division of Population Reg. Res.; No. 85-830-9285-000
Period: 10/76 to 9/77
Funds: $440,000

The effect of sublethal exposure of birds to oil will be studied by correlating experimental and ecological studies that relate toxicological/physiological effects and kinetics of oil in birds to exposure in the environment. Recommendations will be made for guidelines to levels of oil in the environment that are dangerous to the welfare of wild bird populations.

[SSIE No. ZUV-82]

2. GENERAL EFFECTS

R-089-77
STUDY OF OIL SPILLED FROM THE SUPERTANKER METULA

Principal Investigator: Hann, R.W., Jr.
Performing Organization: Texas A & M University System, Graduate School, College Station, TX 77843
Supporting Agency: U.S. Department of Transportation, Office of the Secretary, No. CG59181, Contract CG-62, 281-A
Period: 12/75 to 12/76

The objectives of this project are threefold: 1) to determine and photograph periodically the remaining oil on the shores of the Strait of Magellan; 2) to collect and ship oil samples to the U.S. Coast Guard Research and Development Center for oil fingerprinting; 3) to visually observe the recurring damage and/or resulting recovery in the affected intertidal zone and estuaries.

[SSIE No. GZO-255]

Status: The project is continuing with another site visit to Chile in the winter, 1977-78. In conjunction with this project, the investigators are developing an Oil Spill Technical Assistance Program and preparing a second generation of courses in oil spill cleanup. These courses will expand upon those offered at the Texas A & M Oil Spill Control School in Galveston.

Reports and Publications

OIL POLLUTION FROM THE TANKER "METULA"
Hann, R.W., Jr. 1974.
Texas A & M University Report. 61 p.

The VLCC "Metula" ran aground in the Straits of Magellan in August, 1974, and lost 51,500 tons of oil. The effects of this spill on the shore and the organisms, and the feasibility of cleanup/containment operations are discussed. This spill taught those involved that spills can happen even with superships, that present cleanup methods are for small spills, and that keeping superports offshore helps provide reaction time.

FOLLOW-UP FIELD SURVEY OF THE OIL POLLUTION FROM THE TANKER 'METULA'
Hann, R.W. 1975.
Final report, USCG-D-166-75, Contract DOT-CG-42444-A.
59 p. AD-A017 100/9GA

Most of the 20,000 tons of oil which came ashore is still present; the spill will be a longterm source of water pollution as it leaches and erodes into the water. The intertidal marine life was substantially affected. Marine waterfowl are still suffering from unstabilized oil or mousse at the top of the beach zone and from eating contaminated mussels.

Information Source: H.N. Young, Jr., Texas A & M University,
Civil Engineering Department,
College Station, TX 77843

R-090-77
DAMAGE ASSESSMENT FOLLOWING ALEXANDRIA BAY OIL SPILL

Principal Investigators:	Tyson, W.E., D. Palm, M. Alexander, D. Behrend, J. Geis, T. Lillesand, and R. Marler
Performing Organization:	St. Lawrence E. Ontario Commission, 317 Washington St., Watertown, NY 13601
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development, No. R805031 01
Period:	11/76 to 10/77
Funds:	$59,745

This project is concerned with the environmental and economic impacts of the June 23, 1976 oil spill on the St. Lawrence River. Evaluations will cover the adequacy of the spill clean-up, biological effects on small mammals, water fowl, aquatic and wetland resources, and determination of the levels of petroleum hydrocarbons within the affected ecosystems to assess the extent of contamination and bioaccumulation. Results will provide data for development of policies and procedures dealing with oil transport and spillage in similar areas.

[SSIE No. GMA-3463]

Status: The first year of the two-year study was completed September 23, 1977. An interim report entitled, "Fall 1976 Survey of Residual Contaminants," was issued in January, 1977. No other reports are expected until the end of the granting period, September, 1978.

Reports and Publications

DAMAGE ASSESSMENT STUDIES FOLLOWING ALEXANDRIA BAY OIL SPILL: FALL 1976 FIELD SURVEY OF RESIDUAL CONTAMINANTS
St. Lawrence-Eastern Ontario Commission. 1977.
Interim report, EPA Grant No. R80531010. 22 p.

On June 23, 1976, an estimated 1,166,000 L (308,000 gal) of No. 6 bunker oil were released from a barge after several tanks ruptured as it struck Comfort Shoal upstream of Alexandria Bay. Efforts were undertaken to develop a plan of study to determine the economic and environmental impacts of oil in a riverine environment. The main objective of this study was to determine the effects of time and the elements on residual hydrocarbons. Results are summarized of the fall 1976 field survey.

Information Source: D.J. Palm, Project Manager, St. Lawrence-Eastern Ontario Commission, 317 Washington St., Watertown, NY 13601

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. GENERAL EFFECTS

R-333-74 (renewal)
COASTAL WETLANDS MANAGEMENT

Principal Investigator:	McIntyre, W.G.
Performing Organization:	Louisiana State University, School of Arts and Sciences, University Station, Baton Rouge, LA 70803
Supporting Agency:	Ford Foundation
Period:	7/75 to 9/76

Pollution arising from offshore marine transportation, oil and gas development, and the movement of populations to coastal areas endangers coastal wetlands, which constitute one of the most important support systems for the world's fishery resources. A study of coastal wetlands management will be conducted comparing control policies and programs of the Rhone River in France, the Rhine in the Netherlands, the Mississippi in the U.S., and the Thames in England.

[SSIE No. QY-2559-1]

R-091-77
STUDY OF ENVIRONMENTAL BENEFITS OF EFFLUENT STANDARDS FOR THE OFFSHORE OIL AND GAS

Principal Investigators:	Shore, R., and J.A. Post
Performing Organization:	Energy Resources Company, Inc., 185 Alewife Brook Parkway, Cambridge, MA 02138
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development, Contract 68-01-4177
Period:	8/76 to 2/77
Funds:	$111,309

The impacts of brine discharge on the marine and estuarine environment will be assessed at 4 sites: a coastal bay in Louisiana; Cook Inlet, Alaska; near offshore Gulf of Mexico; and far offshore Gulf of Mexico. A computerized dispersion model is used to calculate contours of brine concentration levels around the discharge point. Data in the literature of the toxic effects of brine constituents (including oil hydrocarbons) are then used in conjunction with the dispersion model results to estimate impacted areas at the study sites.

[SSIE No. GMA-3399]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-092-77
CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT (CEPEX) - ROLE OF BACTERIA IN POLLUTED MARINE ECOSYSTEM
Principal Investigator: Azam, F.
Performing Organization: University of California, Graduate School, P.O. Box 109, San Diego, CA 92037
Supporting Agency: U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-22716
Period: 11/76 to 12/77
Funds: $48,100

For this research, natural marine communities contained in large plastic cylinders are subjected to low-level, long-term exposure to heavy metals and petroleum. One of the five studies deals with bacterial breakdown of selected 14C-labeled petroleum hydrocarbons.

[SSIE No. CH-881]

Reports and Publications

EFFECTS OF FOUR OILS ON MARINE BACTERIAL POPULATIONS: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Hodson, R.E., F. Azam, and R.F. Lee. 1977.
Bulletin of Marine Science 27(1):119-126.

The effects of Louisiana and Kuwait crudes, No. 2, and Bunker-C fuel oils were examined on heterotrophic uptake and mineralization of D-glucose by microbial populations from Saanich Inlet, Canada. All oils inhibited uptake and mineralization, with the two processed oils being more toxic than the crude oils. Populations did not acquire tolerance to oil after one month's exposure.

Information Source: F. Azam, University of California, Graduate School, P.O. Box 109, San Diego, CA 92037

R-093-77
DEEP OCEAN ENVIRONMENTAL STUDIES OF MARINE BACTERIA
Principal Investigator: Colwell, R.R.
Performing Organization: University of Maryland, School of Agriculture, College Park, MD 20742
Supporting Agency: U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-82655
Period: 1/77 to 12/77
Funds: $32,500

Second-year research is being conducted to determine the interaction of microorganisms with the deep-ocean environment under in situ conditions. Rates of utilization will be assessed using seawater samples enriched with chitin, cellulose, carbohydrates, urea, and other organic compounds. Biodegradation experiments will use substrates of petroleum, heavy metals, and pesticides. Other studies will cover metabolic activity, genetic experiments concerning geographic distribution, and the ecological significance of plasmids in the deep sea.

[SSIE No. CM-310]

For a list of publications, see Oil Spill and Oil Pollution Reports, May-July 77, p. 271-274.

2. GENERAL FATE OF OIL

R-302-75 (renewal)
ENVIRONMENTAL ORGANIC GEOCHEMISTRY OF OUTER CONTINENTAL SHELVES

Principal Investigator:	Miller, R.E.
Performing Organization:	U.S. Department of the Interior, Geological Survey, 12201 Sunrise Valley Dr., Herndon, VA 22092
Supporting Agency:	U.S. Department of the Interior, Geological Survey, Geologic Division, No. 9450-01543
Period:	10/76 to 9/77
Funds:	$60,000

The principal objectives of this project are to determine quantitatively the low-level baseline concentrations of naturally occurring organic substances in surface shelf and slope sediments, and to distinguish and classify in core sediments those natural organic substances and organo-metallo complexes that are related to specific geological and geochemical processes.

[SSIE No. ZUA-3570-2]

R-094-77
PETROLEUM HYDROCARBONS IN THE SEDIMENTS OF THE BERMUDA PLATFORM

Principal Investigator:	Butler, J.N.
Performing Organization:	Harvard University, School of Arts & Sciences, Cambridge, MA 02138
Supporting Agency:	U.S. National Science Foundation, Division of Ocean Sciences, No. OCE76-19901
Period:	11/76 to 10/77
Funds:	$22,000

"This research project will sample sediments on the slope of the Bermuda platform at depths from shallow lagoonal to abyssal, and characterize the hydrocarbons found in these sediments using column chromatography, gas chromatography, and mass spectrometry." It is speculated that one possible fate of petroleum residues in the open ocean is accumulation in the sediments.

[SSIE No. CH-875]

R-095-77
EPA/MASS

Principal Investigator:	Galt, J.A.
Performing Organization:	U.S. Department of Commerce, Environmental Research Laboratories, Boulder, CO 80302
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development, No. B7121231
Period:	10/76 to 9/77
Funds:	$80,000

"Develop numerical techniques to model and simulate the marine environment to: 1) aid in the interpretation of observational data, 2) explain dynamic processes controlling the distribution of substances within and on the water, and 3) facilitate the communication and presentation of research results through the development of computer graphics." Modeling and simulation studies are being conducted in support of EPA sponsored pollutant distribution studies.

Status: Initial formulations of oil trajectory models for the Puget Sound region have been constructed.

[SSIE No. GMA-3297]

R-096-77
ENVIRONMENTAL DEGRADATION OF AIR FORCE CHEMICALS IN AIR, WATER AND SOIL

Principal Investigator:	Inman, R.C.
Performing Organization:	U.S. Air Force, Aerospace Medical Research Laboratory, Wright Patterson A.F.B., Dayton, OH 45433
Supporting Agency:	U.S. Department of Defense, Air Force, No. DF320520
Period:	10/76 to 9/77

The degradation of Air Force critical materials introduced into an aquatic or terrestrial environment and the degradation rate kinetics will be studied. Data will be used in compiling environmental impact statements or assessments on weapons systems using these chemicals.

[SSIE No. ZQF-320520]

SECTION III: CURRENT CONFERENCES

*Additional information not available at time of publication.

Aug. 20-27 9th International Seaweed Symposium and meetings of the International Phycological Society and Phycological Society of America, University of California, Santa Barbara, California, 1977.

Oil Pollution Related Papers

TOXICITY OF CRUDE OILS AND FUEL OILS PRESENTED DIRECTLY TO MICROALGAE
Batterton, J. C., K. Winters, and C. Van Baalen

Fuel oils were much more growth-inhibiting than crude oils for a green alga, a blue-green alga, and a diatom. "Baton Rouge" and "New Jersey" fuel oil samples were toxic but were detoxified by heating. Chemical data suggest that the less water-soluble compounds in the higher boiling aromatic fraction are the cause of toxicity.

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION
Steele, R. L.

The author studied two genera of brown algae, *Fucus* and *Laminaria*, to measure oil pollution toxicity in these bioassay organisms. Four kinds of oil were tested and both algae were found to be sensitive at less than 100 ppb. Male reproductive cells were much more sensitive than eggs or female gametophytes.

Proceedings of the Ninth International Seaweed Symposium will be published in 1978 and be available for $25.00 from Science Press, 8 Brookstone Drive, Princeton, NJ 08540

Aug. 28-31 PACHEC '77, 2nd Pacific Area Chemical Engineering Conference, Denver, Colorado.
Sponsored by the Interamerican Confederation of Chemical Engineers, Asian Pacific Confederation of Chemical Engineering, and American Institute of Chemical Engineers.

The program included environmental and safety aspects of energy, petroleum, and petrochemicals production. Sessions 9, 18, and 27 were entitled Environmental Aspects of Shale Oil Production and Processing; Sessions 38 and 47 dealt with Water Problems Associated with Coal Conversion and Shale Oil Production; and Session 45 was entitled Environmental Aspects of Tar Sands Processing.

Proceedings of the Conference are available for $35.00 from AIChE Publications Department, 345 East 47th St., New York, NY 10007

Sept. 12-16 Meeting of the Water Pollution Control Federation of Germany, Essen, Federal Republic of Germany, 1977.

FFI contact Mr. C. H. Plumer, Abwassertechnische Vereinigung, Bertha von Sutter Platz 9, Bonn 53, Federal Republic of Germany

Sept. 13-16 Third Symposium on Environmental Aspects of Fuel Conversion Technology, Hollywood, Florida, 1977.
Sponsored by the U.S. Environmental Protection Agency Industrial Environmental Research Laboratory/RTP.

FFI contact Franklin A. Ayer, Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709

Sept. 26-28 2nd International Symposium on Aquatic Pollutants, Noordwijkerhout (near Amsterdam), The Netherlands, 1977.
Sponsored by the Commission of European Communities, U.S. Environmental Protection Agency, Netherlands Ministry of Public Health and Environmental Hygiene, and others.

The conference included 30 papers on transport, transformation, and biological effects of aquatic pollutants.

FFI contact George L. Baughman, Environmental Research Laboratory, Environmental Protection Agency, College Station Rd., Athens, GA 30601

Sept. 28-30 2nd International Symposium on Polynuclear Aromatic Hydrocarbons, Battelle Columbus Labs, Columbus, Ohio, 1977.

FFI contact Dr. Peter W. Jones, Battelle Columbus Labs, 505 King Ave., Columbus, OH 43201

Oct. 3-6 1977 Refining Department Autumn Meeting, Atlanta, Georgia, 1977.
Sponsored by the American Petroleum Institute.

FFI contact the Conference Department, API Refining Department, 2101 L St., N.W., Washington, D.C. 20037

Oct. 4-5 ASTM Symposium on Chemical Dispersants for the Control of Oil Spills, Williamsburg, Virginia, 1977.
Sponsored by the American Society for Testing and Materials, Committee F-20 on Spill Control Systems.

Oil Pollution Related Papers

Session I

SOME OBSERVATIONS ON THE MECHANISM AND CHEMISTRY ASPECTS OF CHEMICAL DISPERSION
Canevari, G. P.

JOINT US/USSR PROGRAM--DEVELOPMENT OF STANDARD DISPERSANT TESTS
Dorrler, J. S., and L. T. McCarthy, Jr.

TOXICITY TESTING PROCEDURES IN THE UK FOR THE EVALUATION OF OIL SLICK DISPERSANTS
Norton, M. G., F. E. Franklin, and R. A. A. Blackman

A SMALL SCALE LABORATORY DISPERSANT EFFECTIVENESS TEST
Mackay, D., S. Nadeau, and C. Ng

THE ACUTE TOXICITY AND DISPERSING EFFECTIVENESS OF OIL SPILLS DISPERSANTS-RESULTS OF A CANADIAN DISPERSANT TESTING PROGRAM (1973-1977)
Doe, D. G., P. G. Wells, and G. W. Harris

THE FEASIBILITY OF AERIAL APPLICATION OF DISPERSANTS IN THE SOUTHERN BEAUFORT SEA
Ross, C. W.

Session II

DEVELOPMENT OF AN OIL DISPERSANT SPRAYING SYSTEM
Manolio, V. P., Jr., and L. T. McCarthy, Jr.

CHEMICAL CONTROL OF OIL SPILLS AND HAZARDS
Kaufmann, S.

SOME GUIDELINES FOR OIL-SPILL CONTROL IN COASTAL ENVIRONMENTS BASED ON FIELD STUDIES OF THE METULA AND URQUIOLA OIL SPILLS
Hayes, M. O., E. R. Gundlach, A. E. Blount, C. H. Ruby, I. A. Fischer, L. G. Ward, and R. Stein

THE ASSESSMENT PROBLEMS OF WHETHER OR NOT TO TREAT OIL SPILLS
Wilson, M. P., Jr.

OIL SPILL CONTROL CHEMICALS - A CURRENT VIEW
Lindblom, G. P.

Session III

THE PHYSICAL AND CHEMICAL BEHAVIOR OF DISPERSED AND UNDISPERSED OIL SPILLS AT SEA
Johanson, E. E., C. D. McAuliffe, and R. A. Brown

DISPERSANT FIELD TRIALS IN CANADIAN WATER
Gill, S. D.

EVALUATION OF EQUIPMENT FOR AERIAL SPRAYING OF OIL DISPERSANT CHEMICALS
Barker, C. D., G. P. Lindblom, J. C. Jefferies, H. Hawkins, R. J. Fulleylove, J. Nichols, J. H. Arnold, and S. A. Horn

EVALUATION OF SELECTED SURFACTANTS FOR THE PROTECTION OF SHORELINES AND SALT MARSHES FROM OIL SPILLS
Foget, C.

EFFECT OF A CHEMICAL DISPERSANT ON MICROBIAL UTILIZATION OF PETROLEUM
Traxler, R. W., and L. S. Bhattacharya

CHEMICAL ANALYSIS OF DISPERSED OIL IN THE WATER COLUMN
Ahmadjian, M., and P. F. Lynch

Session IV

DROP SIZE DISTRIBUTIONS IN A TREATED OIL-WATER SYSTEM
Jasper, W. L., T. J. Kim, and M. P. Wilson

PRACTICAL EXPERIENCE OF DISPERSANT USAGE
Garnett, M. J., and I. C. White

PROMPT USE OF DISPERSANTS CAN CONTROL OFFSHORE OIL SPILLS
Fitzgerald, D. E.

A SYSTEM FOR THE APPLICATION OF DISPERSANTS TO THE PROBLEMS OF OIL SPILL CLEANING
Cormack, D.

EFFECTS OF DISPERSANT USE ON SHORE LIFE
Nelson, A.

Discussion Session

THE USE OF CHEMICALS TO CONTROL SPILLS OF OIL
Laroche, G., J. Kirkland, M. J. Garnett, and E. W. Mertens

FFI contact Conference Chairman, ASTM Symposium on Chemical Dispersants, 1916 Race St., Philadelphia, PA 19103

Oct. 9-12 52nd SPE-AIME Annual Fall Technology Conference and Exhibition, Denver, Colorado, 1977.

Oil Pollution Related Papers

SPE 6835
POLYMER USE IN BLOWOUT CONTROL
Arnwine, L. C., and J. W. Ely

SPE 6903
AN OFFSHORE BLOWOUT AND HOW IT WAS KILLED
Barnett, R. D.

FFI contact Ms. K. Lee, Meetings Secretary, SPE of AIME, 6200 N. Central Expressway, Dallas, TX 75206

Oct. 11- 14 Long-Term Recovery Potential of Cold-Water Marine Environments after Oil Spills, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, 1977.

Sponsored by the Bedford Institute of Oceanography, Canada Fisheries and Marine Service, Canada Environmental Protection Service, Transport Canada, and The Petroleum Association for the Conservation of the Canadian Environment.

A primary aim of the symposium was to focus on the question of community recovery over time, especially in cold-water environments. Central to the symposium are papers dealing with long-term follow-up studies on four major spills: the 1967 "Torrey Canyon" in the U.K., the 1969 "Florida" in West Falmouth, Mass., the 1970 "Arrow" in Chedabucto Bay, Canada, and the 1974 "Metula" spill in Chile.

Symposium Program

Session 1 - "Long-Term Fate of Petroleum Hydrocarbons after Spills -- Compositional Changes and Microbial Degradation"

BIOTIC AND ABIOTIC CHANGES IN PRUDHOE BAY OIL IN SURFACE AND UNDER-ICE WATERS IN THE ARCTIC
Atlas, R. M.

MICROBIAL ECOLOGY STUDIES OF THE METULA SPILL IN THE STRAITS OF MAGELLAN
Colwell, R. R.

LONG-TERM FATE OF A HEAVY FUEL OIL IN A SPILL-CONTAMINATED B.C. COASTAL BAY
Cretnay, W. J.

GEOCHEMICAL STUDIES OF NO. 2 FUEL OIL SPILLS IN BUZZARDS BAY - 1969 SPILL AND 1974 SPILL
Farrington, J. W.

CHEMICAL AND MICROBIOLOGICAL CHANGES IN THE SAND COLUMN OF A POLLUTED BEACH IN WILHEMSHAVEN
Gassmann, G.

ROLE OF THE BURROWING ANNELID ARENICOLA MARINA IN THE WEATHERING OF OIL IN INTERTIDAL SEDIMENTS
Gordon, D. C., Jr.

ARROW BUNKER C RESIDUES IN SHORE AND BOTTOM SEDIMENTS OF CHEDABUCTO BAY, NOVA SCOTIA
Keizer, P. D., et al

PEABODY CREEK, PORT ANGELES, WASHINGTON - INTERTIDAL SEDIMENT CONTAMINATION AND APPARENT RECOVERY
MacLeod, W. D., et al

BASE-LINE STUDIES OF THE U.K. AND ANTARCTIC COAST
Mackie, P. R.

PETROLEUM HYDROCARBONS IN TISSUES AND SEDIMENTS FROM STEADILY WEATHERING OIL SPILLS - SEARSPORT AND CASCO BAY
Mayo, D., and D. Page

RATES OF MECHANICAL DISPERSAL OF OIL STRANDED IN THE LITTORAL ZONE
Owens, E. H.

HYDROCARBON-UTILIZING BACTERIA FROM SHORELINES AND BOTTOM SEDIMENTS OF CHEDABUCTO BAY, NOVA SCOTIA - POTENTIAL FOR SPILL DEGRADATION
Stewart, J.

ANALYSES OF CHANGES IN AROMATICS IN SEVEN YEARS SINCE THE WEST FALMOUTH OIL SPILLS IN WILD HARBOR MARSH SEDIMENTS: 1969-1976
Teal, J.

EARLY DIAGENETIC CHANGES IN PETROLEUM COMPOUNDS BURIED IN SEDIMENTS
Van Vleet, E. S.

Session II - "Physiological Stresses and Response in Chronically Oiled Organisms."

DEMOGRAPHIC CONSEQUENCES OF SHORT - TERM NATURAL SELECTION ON TWO ALLOZYMIC LOCI IN THE OYSTER DRILL UROSALPINX CINEREA FROM W. FALMOUTH
Cole, T. J.

ALTERATIONS IN PHYSIOLOGY, GROWTH, AND POPULATION STRUCTURE IN THE SOFT-SHELL CLAM MYA ARENARIA FROM CHRONICALLY OILED SEDIMENTS: ARROW 1970-1976
Gilfillan, E.

UPTAKE AND DEPURATION OF AROMATIC PETROLEUM HYDROCARBONS IN SEVERAL SPECIES AFTER A 2,000-TON IRANIAN CRUDE SPILL ON THE WEST COAST OF NORWAY
Grahl-Nielsen, O.

EFFECTS OF SEAWATER EXTRACTS OF EKOFISK OIL ON THE HATCHING SUCCESS OF BARENTS SEA CAPELIN
Johannessen, K. I.

LONG-TERM EFFECTS OF THE WEST FALMOUTH SPILL ON CRAB POPULATIONS: 1969-1976
Krebs, C. T.

EFFECTS OF LOW CONCENTRATIONS OF WATER SOLUBLE FRACTION OF NO. 2 FUEL OIL ON EGGS AND LARVAE OF WINTER FLOUNDER AFTER EXPOSURE OF THE ADULTS DURING MATURATION
Kuhnhold, W. W.

EFFECTS OF LONG-TERM EXPOSURE OF FLATFISH TO SEDIMENT CONTAMINATED WITH ALASKAN CRUDE OIL
McCain, B. B.

GROWTH AND HISTOPATHOLOGICAL CHANGES IN A MARINE FISH AFTER SIX MONTHS EXPOSURE TO PETROLEUM
Payne, J. F.

EFFECTS OF CHRONIC EXPOSURE TO PETROLEUM UPON THE GROWTH OF MARINE ORGANISMS
Percy, J.

BIO-AVAILABILITY OF HYDROCARBONS IN MARINE SEDIMENTS
Roesijadi, G.

THE EFFECTS OF UPTAKE AND DISCHARGE OF PETROLEUM HYDROCARBONS ON THE RESPIRATION OF THE SOFT-SHELL CLAM MYA ARENARIA
Stainken, D.

CYTOCHROME P-450 AND HYDROCARBON METABOLISM IN FISH FROM THE WILD HARBOR MARSH, WEST FALMOUTH
Stegeman, J. J.

TISSUE ARYL HYDROCARBON HYDROXYLASES IN CHRONICALLY OILED SEDIMENTS FROM CHEDABUCTO BAY, NOVA SCOTIA: ARROW 1970-1976
Vandermeulen, J. H.

Session III - "Long-Term Effects of Oil Spills on Marine Intertidal Communities."

RECRUITMENT OF BENTHIC ANIMALS AS A FUNCTION OF PETROLEUM HYDROCARBON CONCENTRATION IN THE SEDIMENT
Anderson, J. W.

LONG-TERM EFFECTS OF OIL POLLUTION ON SOME BRITISH INTERTIDAL COMMUNITIES
Baker, J. M.

OBSERVATIONS OF A COLD-WATER INTERTIDAL COMMUNITY FIVE YEARS AFTER THE GENERAL M.C. MEIGS SPILL
Clark, R. C., Jr.

BIOLOGICAL EFFECTS OF OIL POLLUTION IN THE BALTIC SEA
Ganning, B., and O. Linden

EFFECTS OF OIL ON SALT MARSH VEGETATION: A QUANTITATIVE TWO-YEAR STUDY OF RECRUITMENT AND GROWTH
Hampson, G. R.

RECOVERY OF BENTHIC MACROFAUNA FROM CHRONIC OIL POLLUTION IN THE SEA AREA OFF A REFINERY PLANT, FINLAND
Leppakoski, E. J.

LONG-TERM EFFECTS OF OIL ON BENTHIC COMMUNITY STRUCTURE AT WEST FALMOUTH
Michael, A. D.

LONG-TERM EFFECTS OF AN OIL SPILL ON FUCUS AND MACROFAUNA IN A SMALL BALTIC BAY
Notini, M.

FLORIDA OIL SPILL IMPACT ON THE BUZZARDS BAY BENTHIC FAUNA: WEST FALMOUTH
Sanders, H. L.

RECOLONIZATION OF ROCKY SHORES IN CORNWALL AFTER USE OF TOXIC DETERGENTS TO CLEAN UP THE TORREY CANYON SPILL
Southward, A. J.

INTERTIDAL ECOLOGICAL EFFECTS OF THE METULA OIL SPILL FOR TWO AND A HALF YEARS AFTER THE SPILL
Straughan, D. J.

RECOVERY OF INTERTIDAL FAUNA AND FLORA ON CHRONICALLY OILED SHORES OF CHEDABUCTO BAY: 1970-1977
Thomas, M.

The proceedings of the symposium will be published by the Journal of the Fisheries Research Board of Canada as a special symposium issue. Inquiries should be directed to: Scientific Information and Publications Branch, Fisheries and Marine Service, Department of Fisheries and the Environment, Ottawa, Ontario, Canada K1A 0E6.

Oct. 12-14 9th American Chemical Society Central Regional Meeting, Charleston, West Virginia, 1977.

Oil Pollution Related Papers

Biochemical Program
Symposium on Microbial Transformations of Aromatic Compounds

Paper 16
MICROBIAL OXIDATION OF AROMATIC HYDROCARBONS
Gibson, D. T., R. H. Dodge, and C. E. Cerniglia

Conference abstracts are available from Dr. J. N. Cawse, Union Carbide Corporation, P.O. Box 8361, South Charleston, WV 25303

Oct. 12-14 1977 Pacific Conference on Chemistry and Spectroscopy, Anaheim, California, 1977.
Sponsored by the American Chemical Society and the Society for Applied Spectroscopy.

Oil Pollution Related Papers

Symposium on Practical Applications of Atomic Spectroscopy

Paper 71
APPLICATIONS OF ATOMIC ABSORPTION AND INFRARED SPECTROSCOPY FOR OIL IDENTIFICATION
Coleman, H. J., and P. L. Grizzle

FFI contact Mr. M. M. Owens, Cochairman, ARCO, 1801 East
Sepulveda Blvd., Carson, CA 90745

Oct. 17-19 OCEANS '77, Los Angeles, California, 1977.
Sponsored by the Marine Technology Society and the Institute of Electrical and Electronic Engineers Council on Oceanic Engineering.

"An International Conference to discuss and explore developing technology and its impact on public policy and education with a focus on the Pacific Rim".

Oil Pollution Related Papers

Public Policy Session 5: The Pacific Basin Community

Paper 5D
Palau: "NATIVE PARADISE" OR PETROLEUM SUPERPORT
Soule, D. F.

Technical Session 13: Port Operations

Paper 13B
THE COAST GUARD'S DEEPWATER PORT RESEARCH AND DEVELOPMENT PROGRAM
Jones, R. G.

Paper 13D
PORT PLANNING TO MINIMIZE RISK TO HAZARDOUS MATERIAL VESSEL MOVEMENT
Lancaster, J. H.

Technical Session 28: Tanker Operations

Paper 28A
TANKERS, THE COAST GUARD AND PUBLIC POLICY
Ide, J. C.

Paper 28B
OIL/WATER SEPARATOR FOR DEBALLASTING APPLICATIONS
Mittleman, J., and M. Jones

Paper 28D
VALDEZ NARROWS TANKER SIMULATIONS
Devlin, W. H.

Technical Session 33: Marine Water Quality

Paper 33D
DEVELOPMENT OF OIL SPILL CLEANUP TECHNOLOGY
Jensen, D. S.

Paper 33E
OIL SPILL RECOVERY WITH MAGNETICALLY RETRIEVABLE SORBENTS
Turbeville, J. E.

Technical Session 40: Environmental Aspects of Offshore Petroleum Development

Paper 40A
ENVIRONMENTAL ASPECTS OF DRILLING FLUID AND DRILL CUTTINGS DISPOSAL
Zingula, R.

Paper 40B
ENVIRONMENTAL ASPECTS OF PRODUCED WATER DISPOSAL
Weiss, F. T., and B. Koons

Paper 40C
FATE OF HYDROCARBONS IN MARINE ANIMALS
Lee, R.

Paper 40D
WEATHERING OF SPILLED OIL AND METHODS OF ACCELERATING
McAuliffe, C. D.

Paper 40E
IMPACT OF ALASKAN PETROLEUM TRANSPORT ON THE CALIFORNIA COASTLINE
Stinner, R. J., and S. Wang

Technical Session 43: Safety Aspects of Ship Operations

Paper 43C
TRANS-ALASKA OIL PIPELINE SYSTEM (TAPS) OIL MOVEMENT--MARINE SAFETY CONSIDERATIONS OF MOVEMENT BY SEA
Riedel, W. R.

The OCEANS '77 Conference Record containing the technical papers will be available from IEEE Single Copy Sales, 445 Hoes Lane, Piscataway, NJ 08854

Oct. 17-22 8th International Conference on Water Pollution Research, Sydney, Australia.

FFI contact H. R. Eisenhauer, Canada Department of the Environment, Inland Waters Directorate, Ottawa, Ontario K1A OE7, Canada

Oct. 23-27 27th Canadian Chemical Engineering Conference, Calgary, Alberta, 1977.
Sponsored by the Canadian Society for Mechanical Engineering, Canadian Natural Gas Processing Association, Canadian Natural Gas Processing Supply Men's Association, Coal Association of Canada, Petroleum Society of the Canadian Institute of Mining and Metallurgy, Chemical Institute of Canada, and Alberta Sulfur Research Ltd.

Theme of the conference is Energy and Development.

Oil Pollution Related Papers

Session 1: Oil Sands Symposium 1

THE ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM
Pahl, M. G.

The title program, AOSERP, is a multidisciplinary, intergovernmental applied research effort directed towards the practical solution of social and environmental problems associated with the Athabasca oil sands development. The project, now in its third year, is headed by Alberta Environment and is jointly funded at $4 million per year by the Alberta and Canadian government. Industry is represented through the Oil Sands Environmental Study Group. Research efforts are focused in areas of hydrology, hydrogeology, meteorology, air quality, terrestrial and aquatic fauna, land use and reclamation, vegetation, and human environment.

Session 4: Environmental and Resource Management 1

AN ENVIRONMENTALIST'S PERCEPTION OF THE CANADIAN OIL INDUSTRY
Gallon, G.

A personal viewpoint is presented on the activities of the oil industry in Canada from 1970 to present, addressing major oil company activities including Northern Development, West Coast Oil Port Development, Refining, and media advertisement.

Session 8: Oil Sands Symposium II

SOME ASPECTS OF ATHABASCA OIL SANDS PROCESSING
Moschopedis, S. E., and J. G. Speight

The environmental impact of the gigantic Athabasca oil sands development project has been a cause of some concern, particularly the water-soluble organic materials and dispersed clay that exists in the tailings ponds of oil sands processing plants. The soluble organics are partly aromatic in nature, contain phenolic, carboxylic and sulphonic functions, and act as clay dispersants.

Conference proceedings will be available from the CSChE Publications Department, 906-151 Slater St., Ottawa, Ontario K1P 5H3, Canada.

Oct. 26-28 SPE-AIME Eastern Regional Meeting, Pittsburgh, Pennsylvania, 1977.

Theme of the conference is "Eastern expectations for energy development". The primary aim of the meeting is to clarify what the northeastern U.S. may expect from emerging national energy policies.

Oil Pollution Related Papers

SPE 6623
REGULATORY DRILLING PRACTICES IN THE EASTERN UNITED STATES
Dodd, R. L.

The powers and responsibilities of agencies overseeing oil and gas exploration and drilling activities are reviewed for Kentucky, Maryland, Michigan, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. State oil development policies are compared with state's policies towards other natural resources, industries, and environmental and conservation issues.

FFI contact Ms. K. Lee, Meetings Secretary, SPE of AIME,
6200 North Central Expressway, Dallas, TX 75206

Nov. 1-3 6th International Pollution Engineering Exposition & Congress, Atlanta, Georgia, 1977.

Runs concurrently with the Southern Plant Engineering & Maintenance Show and Conference. Over 300 exhibits by manufacturers of plant operating equipment, maintenance and pollution control products and services are featured, including oil skimmers, adsorbents, and wastewater sampling instrumentation. The conference includes topics in industrial wastewater treatment and disposal, containment of plant spills, and compliance with environmental regulations and standards.

Conference programs are available from Clapp & Poliak, Inc.,
245 Park Avenue, New York, NY 10017

Nov. 2-4 SREL Symposium on Energy and Environmental Stress in Aquatic Systems, Augusta, Georgia, 1977.

The symposium includes topics on contamination from fossil fuels and byproducts.

FFI contact Dr. James H. Thorp, Savannah River Ecology
Laboratory, Drawer E, Aiken, SC 29801

Nov. 4-5 SPE-AIME Trinidad-Tobago Petroleum Exposition and Conference, Port-of-Spain, 1977.

Oil Pollution Related Papers

SPE 7031
OIL SPILL CONTINGENCY PLANNING
Hinds, H. C., and R. A. Mends

SPE 7035
SAFETY AND PROPOSED DRILLING REGULATIONS FOR TRINIDAD
Kin, F. L.

FFI contact Ms. K. Lee, Meetings Secretary, SPE of AIME,
6200 North Central Expressway, Dallas, TX 75206

Nov. 6-11 4th Joint Conference on Sensing of Environmental Pollutants, New Orleans, Louisiana, 1977.
Sponsored by the ACS, AIAA, AIChE, AME, EPA, ERDA, IEEE, Instrument Society of America, NASA, NOAA, U.S. Department of Housing and Urban Development, USGS, U.S. Department of State, U.S. Department of Transportation.

Oil Pollution Related Papers

Session VI-D: New Analytical Techniques for Environmental Sensing and Assessment - I

Paper 165
ANALYSIS OF ENVIRONMENTAL POLLUTANTS USING ION CHROMATOGRAPHY
Long, T. S., and A. L. Reinsvold

Paper 170
DIFFERENTIAL ABSORPTION TECHNIQUES FOR MEASUREMENT OF REACTIVE HYDROCARBONS
Baskins, L. L.

Session VI-E: Sensing of Water and Land Pollution in the Coastal Zone

Paper 175
SIGNATURE EXTRACTION OF OCEAN POLLUTANTS BY EIGENVECTOR TRANSFORMATION OF REMOTE SPECTRA
Crew, G. W.

Paper 176
MARINE POLLUTION MONITORING UTILIZING AN AIRBORNE FRAUNHOFER LINE DISCRIMINATOR
Watson, R. D., M. E. Henry, A. F. Theisen, T. J. Donovan, and W. R. Hemphill

Session VII-E: Remote Sensing of Water and Land Pollution

Paper 207
DEVELOPMENT OF AN AIRBORNE LASER FLUOROSENSOR FOR OIL AND WATER POLLUTION MONITORING
Houston, W. R., W. Morrow, and J. H. Davies

Proceedings are available for $50.00 from Barbara R. Hodsdon, Conference Manager, American Chemical Society, 1155 16th St., N.W., Washington, D.C. 20036

Nov. 9-11 SERACS 29 (29th Annual ACS Southeast Regional Meeting), Tampa, Florida, 1977.
Sponsored by the American Chemical Society Florida Section.

Oil Pollution Related Papers

Marine Chemistry Symposium

Paper 300
ANALYSIS OF ACCUMULATED PETROLEUM HYDROCARBONS IN TISSUES OF OIL-EXPOSED MALLARD DUCKS (ANAS PLATYRHYNCHOS)
Lawler, G. C., W.-A. Loong, and J. L. Laseter

FFI contact A. T. Winstead, American Chemical Society,
1155 16th St., N.W., Washington, D.C. 20036

Nov. 10-12 SNAME 1977 Annual Meeting, New York City, New York, 1977.

FFI contact the Society of Naval Architects and Marine Engineers, One World Trade Center, Ste 1369, New York, NY 10048

Nov. 13-17 70th AIChE Annual Meeting, New York City, New York, 1977.

The conference program covers topics on fuels and petrochemicals. Included are two sessions entitled, "Energy, Environment and Cost: a Challenge to Refining and Petrochemical Operations," and a session on environmental aspects of water, industrial wastes, runoff, wastewater treatment and disposal, and wastewater monitoring.

Oil Pollution Related Papers

Session 58: Energy, Environment, and Cost: A Challenge to Refining and Petrochemical Operations

Paper 58c
ENVIRONMENTAL ASPECTS OF LOCATING A GRASS ROOTS REFINERY IN AN ENVIRONMENTALLY SENSITIVE AREA
Rayford, R., and B. Rubin

Features of refinery design and operation which are necessary for adequate environmental protection are discussed. The modification of an existing refinery and the design of a new facility are described, using case examples. Problems of siting refineries in environmentally sensitive areas are considered.

Session 92: Toxic Effluents and Toxic Spills - Safety and Environmental Aspects. Part I

Paper 92a
EPA REGULATIONS ON TOXIC SPILLS AND TOXIC POLLUTANTS
Jennings, A.

Present and proposed EPA regulations regarding toxic oil and chemical spills are discussed and their key features are detailed.

Paper 92b
CHEMICAL INDUSTRY VIEWPOINTS ON TOXIC SPILLS AND TOXIC POLLUTANTS
Ladd, E. C., and R. L. Pellissier

The chemical industry's perspective on the problem of toxic oil and chemical spills is presented, and the effects of present and proposed regulations on plant operation costs and methods are discussed.

Paper 92c
SAFETY ASPECTS OF TOXIC SPILLS AND TOXIC POLLUTANTS
Wood, W. S.

The safety aspects of toxic oil and chemical spills are presented, including the potential of fires, explosions and hazards to life and property. Safety measures in the chemical industry are featured.

Paper 92d
MODELING AND MONITORING OF TOXIC SPILLS AND TOXIC EFFLUENTS
Kenson, R. E.

Problems of monitoring and modeling toxic oil and chemical spills are discussed, and suitable standard methods are proposed. State-of-the-art techniques are reviewed.

Paper 92e
BIOLOGICAL ASPECTS OF TOXIC SPILLS AND TOXIC POLLUTANTS
Nadeau, R.

The effects of toxic oil and chemical spills on biological systems are reviewed. Most data available deal with aquatic organisms, however some data on effects of spills on terrestrial organisms are recorded.

Paper 92f
TECHNICAL ASPECTS OF TOXIC SPILLS/TOXIC POLLUTANTS CLEANUP
Larkman, D. F. G.

Responsibilities of the chemical industry for cleaning up toxic oil and chemical spills are discussed, and a review of currently available technology is presented.

Session 101: Land Application Technology For Industrial Wastes. Part 1

Paper 101b
BIODEGRADATION OF POLYNUCLEAR AROMATIC HYDROCARBON POLLUTANTS BY SOIL AND WATER MICROORGANISMS
Mc Kenna, E. J.

This study delineated the biodegradability of polynuclear aromatic hydrocarbons (PNA) by soil and water organisms, and determined the persistence of selected PNA components by measuring residual hydrocarbons in microbial cultures as a function of time.

Paper 101d
ELECTROLYTIC TREATMENT OF DILUTE EMULSIFIED OILY WASTEWATERS
Weintraub, M. H.

Electrolytic treatment of emulsified oil in dilute oily wastewater is described, and design and economic considerations for treatment facilities are discussed.

Paper 116d
SOIL DISPOSAL OF PETROCHEMICAL WASTE EFFLUENTS
Brown, K. W., and L. E. Deuel

The feasibility of using land disposal for petrochemical wastewaters was investigated. The toxicity of the wastewaters was evaluated for three plant species, and the toxic effects were reduced by dilution and rinsing after application. Nitrates in wastes were not found to dissipate into groundwater.

FFI contact W. H. McCarty, Mobil Chemical Co. Research and Development Laboratories, P.O. Box 240, Edison, NJ 08817

Nov. 14-15	Annual Meeting of the American Petroleum Institute, Houston, Texas, 1977.

FFI contact the Conference Department, American Petroleum Institute, 2101 L St., N.W., Washington, D.C. 20037

MASTER LIST OF KEYWORDS

S: See
SA: See also

Absorption
Activated sludge
Acute effects
Adriatic Sea
Adsorption
Aegean Sea
Africa
Alabama
Alaska
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Wastewater disposal ... SA: Disposal
Wastewater treatment
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SUBJECT INDEX

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1711 ABSORPTION, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEAWATER, BEACHES, SPECTROSCOPY, CHROMATOGRAPHY,
1743 ABSORPTION, SPILL RECOVERY, DESIGN-ENGINEERING, USN, *FOAM CHIPS,
1750 ABSORPTION, SPILL RECOVERY, SKIMMERS, BOOMS, SHIPS,
1760 ABSORPTION, SPILL CLEANUP, SPILL CONTAINMENT, *POLYURETHANE FOAMS,
1763 ABSORPTION, CONTAMINANTS, PATENT, *OIL-ABSORBENT COMPOUND,
1765 ABSORPTION, CONTAMINATION, OIL TANKS, PATENT, *CLEANUP ,
1769 ABSORPTION, SPILL RECOVERY, COST ANALYSIS, *SORBENTS, *PERFORMANCE EVALUATION,
1771 ABSORPTION, SPILL CLEANUP, PETROLEUM PRODUCTS, SOIL, SOURCES, BIODEGRADATION, OXIDATION,
1776 ABSORPTION, SPILL RECOVERY, INCINERATION, PATENT, *ABSORBENT FIBERS,
1778 ABSORPTION, SPILL CLEANUP, OCEANS, *POLYURETHANE FOAMS,
1781 ABSORPTION, SPILL RECOVERY, SURFACTANTS, *SORBENT WOOD CHIPS,
1782 ABSORPTION, OIL SLICKS, SPILL RECOVERY, PATENT,
1790 ABSORPTION, SPILL CLEANUP, INCINERATION, *GELLING AGENTS,
1791 ABSORPTION, SPILL CLEANUP, DISPERSANTS, DISPOSAL , COASTS, MARSHES, BEACHES, SEAWATER, FRESHWATER,
1853 ABSORPTION, WASTEWATER TREATMENT, SPILL RECOVERY, OIL-WATER SEPARATION, PATENT, *SORBENT MATERIAL,
1866 ABSORPTION, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, PATENT, *ABSORBENT POLYOLEFIN,
1820 ACTIVATED SLUDGE , WASTEWATER TREATMENT, BIODEGRADATION, REFINERIES,
1726 ADSORPTION, PETROLEUM PRODUCTS, HYDROCARBONS, SEAWATER, SURFACTANTS, CHEMICAL ANALYSIS, *ELECTROANALYSIS ,
1759 ADSORPTION, FUEL OIL, CONTAMINATION, FRESHWATER, *ACTIVATED CARBON, *WATER SUPPLY,
1777 ADSORPTION, SPILL RECOVERY, FUEL OIL, PATENT, *SAWDUST,
1787 ADSORPTION, SPILL CLEANUP, GASOLINE, FUEL OIL, PATENT,
1802 ADSORPTION, OIL TRANSPORT, GROUNDWATER, *LIME, *CLAY, *SOIL COMPONENTS,
1832 ADSORPTION, WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION, OXIDATION, PATENT,
1850 ADSORPTION, WASTEWATER TREATMENT, EMULSIFIERS, SLUDGE, FLOTATION, PATENT,
1872 ADSORPTION, WASTEWATER TREATMENT, EMULSIONS, FILTRATION, POLAND, *CELLULOSE, *DIATOMACEOUS EARTH,
2100 ADSORPTION, CRUDE OIL, HYDROCARBONS, SOIL, *DESORPTION, *ORGANIC MATTER CONTENT,
1939 AEGEAN SEA, CONTAMINATION, CHRONIC EFFECTS, PHYTOPLANKTON,
1651 ALASKA, OIL SPILLS, PIPELINES, CRUDE OIL, *PUMP STATION ACCIDENT,
1653 ALASKA, OIL SPILLS, CRUDE OIL, PIPELINES, *PUMP STATION ACCIDENT,
1657 ALASKA, OIL SPILLS, OCEANS, STATISTICS, COASTS,
1673 ALASKA, MONITORING, FATE, CRUDE OIL, MOVEMENT, BIOLOGICAL EFFECTS, MICROORGANISMS, CHEMICAL EFFECTS, *PERMAFROST TERRAIN,
1797 ALASKA, OIL TRANSPORT, PIPELINES, TEXAS, EIS, CRUDE OIL, OIL SPILLS,
1989 ALASKA, OIL SPILLS, LIABILITY, REGULATIONS, TANKERS, OIL TRANSFER, PORTS, *OIL SPILL FUND,
1999 ALASKA, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, OIL SPILLS, VEGETATION, SOIL, MARSHES,
2013 ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OCS, MARINE MAMMALS, BIRDS,
2014 ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OCS, FISH, PLANKTON , BENTHOS,
2015 ALASKA, BIRDS, HABITAT, SHORELINES, ARCTIC, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, *SHOREBIRD SPECIES,
2016 ALASKA, BIRDS, SHORELINES, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES,
2022 ALASKA, OFFSHORE DRILLING, SOCIO-ECONOMIC EFFECTS, OCS, CRUDE OIL, *SEA GRANT PROGRAM, *ENERGY POLICY,
2033 ALASKA, OIL-GAS LEASING, OCS, EIS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS,
2037 ALASKA, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, MARINE MAMMALS, OCS, *MORTALITY,
2045 ALASKA, OFFSHORE DEVELOPMENT, CRUDE OIL, OCS, ENVIRONMENTAL EFFECTS, OIL-GAS LEASING,
2071 ALASKA, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, GASOLINE, LAKES, SEDIMENTS,
2095 ALASKA, OIL SPILLS, MOVEMENT, *COASTAL WINDS,
2096 ALASKA, OIL SPILLS, FATE, ICE, *OIL-UNDER-ICE , *IMPULSE RADAR SYSTEM,
2102 ALASKA, UPTAKE, RELEASE, HYDROCARBONS, SEDIMENTS, OIL SLICKS, INTERTIDAL ZONE,
1676 ALASKA COAST, MONITORING, BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, INFORMATION SYSTEMS, NOAA, BLM,
2098 ALASKA COAST, OIL SPILLS, MOVEMENT, SHORELINES, *SPILL IMPACT PROBABILITY, BEAUFORT SEA,

1700 ALASKA/GULF OF, SAMPLING, TAR, *PLASTICS, DISTRIBUTION, BERING SEA,

2027 ALASKA/GULF OF, OFFSHORE EXPLORATION, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, OCS, BERING SEA,

1794 ALGAE, RESTORATION, SHORELINES, OIL SPILLS, BIOLOGICAL EFFECTS, MOLLUSKS, *ROCKY SHORES, ENGLAND,

1914 ALGAE, TOXICITY, CRUDE OIL, FUEL OIL,

1955 ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, GASOLINE, BIODEGRADATION, TOXICITY, BACTERIA, FRESHWATER, *PHOTOSYNTHESIS,

1969 ALGAE, PETROLEUM PRODUCTS, FUELS, CRUDE OIL, BIOLOGICAL EFFECTS, *GROWTH, *REPRODUCTION, *FUCUS EDENTATUS DE LA PYL,

1970 ALGAE, TOXICITY, *REPRODUCTION,

1978 ALGAE, TOXICITY, SURFACTANTS, EMULSIFIERS, *SEAWEED, *GROWTH RATES,

1667 ANALYTICAL TECHNIQUES, MONITORING, CONTAMINANTS, SAMPLING,

1701 ANALYTICAL TECHNIQUES, OIL-WATER SEPARATION, DETECTION, PATENT, *OIL-IN-WATER, *FLUORESCENCE,

1706 ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, FOSSIL FUELS ,

1711 ANALYTICAL TECHNIQUES, ABSORPTION, HYDROCARBONS, SEAWATER, BEACHES, SPECTROSCOPY, CHROMATOGRAPHY,

1713 ANALYTICAL TECHNIQUES, SAMPLING, HYDROCARBONS, SEDIMENTS, INTERTIDAL ZONE, WASHINGTON,

1716 ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, SEAWATER, *GRAVIMETRIC ANALYSIS, *SPECTROPHOTOMETRY,

1720 ANALYTICAL TECHNIQUES, CONTAMINATION, *OPTICAL EMISSION, CASPIAN SEA, *SEA SURFACE,

1724 ANALYTICAL TECHNIQUES, CRUDE OIL, FUEL OIL, *OIL-GREASE DETERMINATION,

1725 ANALYTICAL TECHNIQUES, HYDROCARBONS, SEDIMENTS, CHROMATOGRAPHY, SPECTROSCOPY, *INTERCALIBRATION,

1727 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, CRUDE OIL, FUEL OIL, PETROLEUM PRODUCTS, SPECTROSCOPY,

1728 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS,

1913 ANALYTICAL TECHNIQUES, TOXICITY, HYDROCARBONS, MARINE ORGANISMS, METABOLISM, BEHAVIOR, *SUBLETHAL LEVELS,

1936 ANALYTICAL TECHNIQUES, FISH, BIOLOGICAL EFFECTS, HYDROCARBONS, *TISSUES, *MORPHOLOGICAL CHANGES,

2128 ANIMALS, BIBLIOGRAPHIES, OIL SPILLS, BIOLOGICAL EFFECTS, PLANTS, MICROORGANISMS,

1912 ANNELIDS, HYDROCARBONS, SEDIMENT, UPTAKE, RELEASE, *PHASCOLOSOMA AGASSIZII, *NAPHTHALENES,

1987 API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL, WASTEWATER TREATMENT, REFINERIES, COST ANALYSIS,

1990 API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL, ECONOMIC EFFECTS, COST ANALYSIS, EPA,

1891 ARCTIC, OFFSHORE DRILLING, SAFETY, POLLUTION PREVENTION, *ICEBERGS, GREENLAND,

1905 ARCTIC, OIL SPILLS, POLLUTION CONTROL, BEAUFORT SEA, *SPILL COUNTERMEASURES,

1951 ARCTIC, HYDROCARBONS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ECOSYSTEMS, SUBARCTIC REGIONS,

1980 ARCTIC, CRUDE OIL, TOXICITY, PHYTOPLANKTON, FRESHWATER, *PRIMARY PRODUCTION,

2015 ARCTIC, ALASKA, BIRDS, HABITAT, SHORELINES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, *SHOREBIRD SPECIES,

2017 ARCTIC, OIL TRANSPORT, PIPELINES, ENVIRONMENTAL EFFECTS, FRESHWATER, EPA,

2034 ARCTIC, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, CANADA, ICE, OIL INDUSTRY,

2054 ARCTIC, OFFSHORE DEVELOPMENT, ICE, ENVIRONMENTAL EFFECTS, *ICE COVERED WATERS, *RESEARCH TECHNOLOGY,

2058 ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, BEAUFORT SEA,

2072 ARCTIC, BIODEGRADATION, GASOLINE, BIOLOGICAL EFFECTS, MICROORGANISMS, LAKES,

2076 ARCTIC, BIODEGRADATION, HYDROCARBONS, METABOLISM, MARINE ORGANISMS, SUBARCTIC REGIONS, TOXICITY,

1638 ARCTIC OCEAN, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, CANADA,

2057 ARCTIC OCEAN, BIODEGRADATION, MICROORGANISMS, *14C-DODECANE OXIDATION , *PORT VALDEZ,

2070 ARCTIC OCEAN, BIODEGRADATION, OIL SLICKS, MICROORGANISMS, *CONTINUOUS FLOW-THROUGH SYSTEM,

1941 ARGENTINA, BIRDS, CONTAMINATION, COASTS, *TIERRA DEL FUEGO, *PENGUINS, *MORTALITY,

1640 ARGO MERCHANT SPILL, TANKERS, LIABILITY, SPILL CLEANUP,

1641 ARGO MERCHANT SPILL, MONITORING, MOVEMENT, POLLUTION PREVENTION, TANKERS, USGS,

1668 ARGO MERCHANT SPILL, MONITORING, CHESAPEAKE BAY,

1922 ARGO MERCHANT SPILL, BIOLOGICAL EFFECTS, INVERTEBRATES, FISH, FOOD WEB,

2001 ARGO MERCHANT SPILL, DISTRIBUTION, ENVIRONMENTAL EFFECTS, COASTS, ATLANTIC OCEAN,

2090 ARGO MERCHANT SPILL, MONITORING, ENVIRONMENTAL EFFECTS, BEHAVIOR, MOVEMENT, SAMPLING,

1707 AROMATIC HYDROCARBONS , CHEMICAL ANALYSIS, SEAWATER, *ELECTROCHEMICAL ANALYSIS ,

1717 AROMATIC HYDROCARBONS , CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, MONITORING, SEDIMENTS, *GLASS CAPILLARY COLUMNS,

1915 AROMATIC HYDROCARBONS , CRUSTACEANS, BIOLOGICAL EFFECTS, ESTUARIES, *COPEPOD,

1920 AROMATIC HYDROCARBONS , CRUDE OIL, TOXICITY, CRUSTACEANS, *LARVAL DEVELOPMENT, *CANCER MAGISTER,

2003 AROMATIC HYDROCARBONS , CRUDE OIL, OFFSHORE DEVELOPMENT, FISHERIES, NORTH SEA,

2063 AROMATIC HYDROCARBONS , BIODEGRADATION, HYDROCARBONS, YEASTS, BACTERIA, OIL SLICKS, *CHLORINATED HYDROCARBONS ,

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1706 ATLANTIC COAST, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION, CANADA,
1967 ATLANTIC COAST, OIL DISCHARGES, HYDROCARBONS, CONTAMINATION, PHYTOPLANKTON, OCS,
2038 ATLANTIC COAST, BASELINE STUDIES, OCS, OFFSHORE DEVELOPMENT, HYDROCARBONS, CHEMICAL ANALYSIS,
2047 ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS, ENVIRONMENTAL DETERIORATION,
2048 ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS, ENVIRONMENTAL EFFECTS, FISHERIES, NEW JERSEY, DELAWARE,
1648 ATLANTIC OCEAN, TAR, OCEANS, DISTRIBUTION, CANADA, SARGASSO SEA,
1997 ATLANTIC OCEAN, OIL SPILLS, ENVIRONMENTAL EFFECTS, US, *WORLD WAR II,
2001 ATLANTIC OCEAN, ARGO MERCHANT SPILL, DISTRIBUTION, ENVIRONMENTAL EFFECTS, COASTS,
1672 AUSTRALIA, MONITORING, HYDROCARBONS, SOURCES, DISTRIBUTION, CHRONIC EFFECTS, *MYTILUS EDULIS, *INDICATOR SPECIES,
1919 BACTERIA, CRUDE OIL, BIOLOGICAL EFFECTS, FUNGI, ICE, FRESHWATER, *OIL-UNDER-ICE ,
1955 BACTERIA, ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, GASOLINE, BIODEGRADATION, TOXICITY, FRESHWATER, *PHOTOSYNTHESIS,
1957 BACTERIA, BIOLOGICAL EFFECTS, BIOMASS, SEDIMENTS, MICROORGANISMS, INTERTIDAL ZONE,
2006 BACTERIA, PETROLEUM PRODUCTS, LUBRICATING OIL, MOVEMENT, SOIL, BIOLOGICAL EFFECTS,
2059 BACTERIA, BIODEGRADATION, CRUDE OIL, PETROLEUM PRODUCTS, PATENT, *NUTRIENT ADDITION,
2060 BACTERIA, BIODEGRADATION, HYDROCARBONS, EMULSIFICATION, FRESHWATER, *KEROSENE,
2061 BACTERIA, BIODEGRADATION, ESTUARIES, *ENRICHMENT TECHNIQUES,
2062 BACTERIA, BIODEGRADATION, HYDROCARBONS, SEDIMENT, BEACHES, MAGELLAN/STRAIT OF, METULA SPILL,
2063 BACTERIA, AROMATIC HYDROCARBONS , BIODEGRADATION, HYDROCARBONS, YEASTS, OIL SLICKS, *CHLORINATED HYDROCARBONS ,
2065 BACTERIA, BIODEGRADATION, OIL SHALE, HYDROCARBONS,
2066 BACTERIA, BIODEGRADATION, HYDROCARBONS, *TAXONOMY,
2069 BACTERIA, BIODEGRADATION, HYDROCARBONS, FUNGI, FRESHWATER, SEDIMENTS,
2073 BACTERIA, BIODEGRADATION, CRUDE OIL, DISPERSANTS,
2074 BACTERIA, AROMATIC HYDROCARBONS , BIODEGRADATION, *ACINETOBACTER,
2075 BACTERIA, BIODEGRADATION, WASTE OIL, SOIL, MONITORING, FUNGI, *ARID SITE,
2080 BACTERIA, BIODEGRADATION, FUEL OIL, PETROLEUM PRODUCTS, OXIDATION, CASPIAN SEA,
2081 BACTERIA, BIODEGRADATION, HYDROCARBONS, LAKES, WATER QUALITY, WISCONSIN, *NUTRIENT LIMITATION,
2082 BACTERIA, BIODEGRADATION, CRUDE OIL, HYDROCARBONS, SOIL, CANADA, *NUTRIENT ADDITION,
1956 BALTIC SEA, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, SPILL CLEANUP,
1982 BALTIC SEA, CONTAMINATION, BIOLOGICAL EFFECTS,
2094 BALTIC SEA, OIL SPILLS, MODELS, FATE, BIODEGRADATION, DISTRIBUTION, INTERTIDAL ZONE,
1676 BASELINE STUDIES, ALASKA COAST, MONITORING, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, INFORMATION SYSTEMS, NOAA, BLM,
1714 BASELINE STUDIES, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION, HYDROCARBONS, MARINE ORGANISMS,
2013 BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, MARINE MAMMALS, BIRDS,
2014 BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, FISH, PLANKTON , BENTHOS,
2016 BASELINE STUDIES, ALASKA, BIRDS, SHORELINES, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS,
2028 BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, CALIFORNIA/SOUTHERN,
2029 BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, CALIFORNIA/SOUTHERN,
2030 BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, CALIFORNIA/SOUTHERN,
2031 BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, CALIFORNIA/SOUTHERN,
2032 BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, EIS, ENVIRONMENTAL EFFECTS, CALIFORNIA/SOUTHERN,
2038 BASELINE STUDIES, ATLANTIC COAST, OCS, OFFSHORE DEVELOPMENT, HYDROCARBONS, CHEMICAL ANALYSIS,
1711 BEACHES, ANALYTICAL TECHNIQUES, ABSORPTION, HYDROCARBONS, SEAWATER, SPECTROSCOPY, CHROMATOGRAPHY,
1783 BEACHES, SPILL RECOVERY, DISPERSANTS, SURFACTANTS, PATENT,
1791 BEACHES, ABSORPTION, SPILL CLEANUP, DISPERSANTS, DISPOSAL , COASTS, MARSHES, SEAWATER, FRESHWATER,
1993 BEACHES, METULA SPILL, ENVIRONMENTAL EFFECTS, SEDIMENTS, MAGELLAN/STRAIT OF,
2062 BEACHES, BACTERIA, BIODEGRADATION, HYDROCARBONS, SEDIMENT, MAGELLAN/STRAIT OF, METULA SPILL,
1905 BEAUFORT SEA, ARCTIC, OIL SPILLS, POLLUTION CONTROL, *SPILL COUNTERMEASURES,
1924 BEAUFORT SEA, BIOLOGICAL EFFECTS, HYDROCARBONS, CRUDE OIL, UPTAKE, MARINE MAMMALS, *RINGED SEAL,
2056 BEAUFORT SEA, ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS,
2077 BEAUFORT SEA, BIODEGRADATION, HYDROCARBONS, CRUDE OIL, ICE, SEDIMENTS, SEAWATER,

2086 BEAUFORT SEA, OIL SPILLS, SPREADING, ICE, *UNDER-ICE SPILL,
2098 BEAUFORT SEA, ALASKA COAST, OIL SPILLS, MOVEMENT, SHORELINES, *SPILL IMPACT PROBABILITY,
1664 BEHAVIOR, OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, SPILL CLEANUP, MONITORING, *1977 OIL SPILL CONFERENCE,
1738 BEHAVIOR, SPILL CONTAINMENT, BOOMS, OIL SLICKS, *SLICK DROPLET FORMATION, *ENTRAINMENT FAILURE,
1913 BEHAVIOR, ANALYTICAL TECHNIQUES, TOXICITY, HYDROCARBONS, MARINE ORGANISMS, METABOLISM, *SUBLETHAL LEVELS,
2090 BEHAVIOR, ARGO MERCHANT SPILL, MONITORING, ENVIRONMENTAL EFFECTS, MOVEMENT, SAMPLING,
2104 BEHAVIOR, OIL SLICKS, PHYSICAL EFFECTS, MODELS, *WIND-CURRENT EFFECTS,
1940 BENTHOS, CRUDE OIL, TOXICITY, PLANKTON , OCS, *NEW YORK BIGHT, NEW YORK,
1961 BENTHOS, POLLUTION CONTROL, BIOLOGICAL EFFECTS, COASTS, *PELAGIC ORGANISMS,
2014 BENTHOS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, FISH, PLANKTON ,
1700 BERING SEA, ALASKA/GULF OF, SAMPLING, TAR, *PLASTICS, DISTRIBUTION,
2027 BERING SEA, ALASKA/GULF OF, OFFSHORE EXPLORATION, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, OCS,
1697 BIBLIOGRAPHIES, REMOTE SENSING, OIL SLICKS, OCEANS, *RADAR, *SEA SURFACE,
1965 BIBLIOGRAPHIES, HYDROCARBONS, CRUDE OIL, TOXICITY, MOLLUSKS, SURFACTANTS, EMULSIFIERS, *MUSSELS,
2127 BIBLIOGRAPHIES, FISH, FRESHWATER, BIOLOGICAL EFFECTS,
2128 BIBLIOGRAPHIES, ANIMALS, OIL SPILLS, BIOLOGICAL EFFECTS, PLANTS, MICROORGANISMS,
2129 BIBLIOGRAPHIES, OIL SHALE, DEVELOPMENT , EXTRACTION, ENVIRONMENTAL EFFECTS,
2130 BIBLIOGRAPHIES, OIL SHALE, DEVELOPMENT , EXTRACTION, ENVIRONMENTAL EFFECTS,
2131 BIBLIOGRAPHIES, OIL SHALE, DEVELOPMENT , EXTRACTION, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
2132 BIBLIOGRAPHIES, OIL SHALE, DEVELOPMENT , EXTRACTION, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
2133 BIBLIOGRAPHIES, ESTUARIES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS,
2134 BIBLIOGRAPHIES, LEGISLATION, US, POLLUTION CONTROL,
2135 BIBLIOGRAPHIES, DETECTION, SAMPLING, MONITORING, CHEMICAL ANALYSIS, REMOTE SENSING,
2136 BIBLIOGRAPHIES, CONTAMINATION, CARIBBEAN SEA, MARINE ORGANISMS,
1684 BILGES, MONITORING, SHIPS, DESIGN-ENGINEERING, DETECTION,
1685 BILGES, MONITORING, DESIGN-ENGINEERING, *TOTAL ORGANIC CARBON DETERMINATION,
1722 BIODEGRADATION, CHEMICAL ANALYSIS, NATURAL SEEPAGE, WEATHERING, CHROMATOGRAPHY, SPECTROMETRY, SANTA BARBARA CHANNEL, CALIFORNIA/SOUTHERN,
1771 BIODEGRADATION, ABSORPTION, SPILL CLEANUP, PETROLEUM PRODUCTS, SOIL, SOURCES, OXIDATION,
1820 BIODEGRADATION, ACTIVATED SLUDGE , WASTEWATER TREATMENT, REFINERIES,
1821 BIODEGRADATION, WASTEWATERS, SPILL CLEANUP, PATENT, *H202,
1925 BIODEGRADATION, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, MARSHES, *SALTMARSH,
1955 BIODEGRADATION, BACTERIA, ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, GASOLINE, TOXICITY, FRESHWATER, *PHOTOSYNTHESIS,
2057 BIODEGRADATION, ARCTIC OCEAN, MICROORGANISMS, *14C-DODECANE OXIDATION , *PORT VALDEZ,
2058 BIODEGRADATION, BEAUFORT SEA, ARCTIC, CRUDE OIL, MICROORGANISMS,
2059 BIODEGRADATION, BACTERIA, CRUDE OIL, PETROLEUM PRODUCTS, PATENT, *NUTRIENT ADDITION,
2060 BIODEGRADATION, BACTERIA, HYDROCARBONS, EMULSIFICATION, FRESHWATER, *KEROSENE,
2061 BIODEGRADATION, BACTERIA, ESTUARIES, *ENRICHMENT TECHNIQUES,
2062 BIODEGRADATION, BEACHES, BACTERIA, HYDROCARBONS, SEDIMENT, MAGELLAN/STRAIT OF, METULA SPILL,
2063 BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS , HYDROCARBONS, YEASTS, OIL SLICKS, *CHLORINATED HYDROCARBONS ,
2064 BIODEGRADATION, SLUDGE, SOIL, DISPOSAL , WASTE OIL, REFINERIES,
2065 BIODEGRADATION, BACTERIA, OIL SHALE, HYDROCARBONS,
2066 BIODEGRADATION, BACTERIA, HYDROCARBONS, *TAXONOMY,
2067 BIODEGRADATION, CRUDE OIL, OXIDATION, UPTAKE, *TEMPERATURE EFFECTS,
2068 BIODEGRADATION, AROMATIC HYDROCARBONS , MICROORGANISMS, SOURCES,
2069 BIODEGRADATION, BACTERIA, HYDROCARBONS, FUNGI, FRESHWATER, SEDIMENTS,
2070 BIODEGRADATION, ARCTIC OCEAN, OIL SLICKS, MICROORGANISMS, *CONTINUOUS FLOW-THROUGH SYSTEM,
2071 BIODEGRADATION, ALASKA, HYDROCARBONS, MICROORGANISMS, GASOLINE, LAKES, SEDIMENTS,
2072 BIODEGRADATION, ARCTIC, GASOLINE, BIOLOGICAL EFFECTS, MICROORGANISMS, LAKES,
2073 BIODEGRADATION, BACTERIA, CRUDE OIL, DISPERSANTS,
2074 BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS , *ACINETOBACTER,
2075 BIODEGRADATION, BACTERIA, WASTE OIL, SOIL, MONITORING, FUNGI, *ARID SITE,
2076 BIODEGRADATION, ARCTIC, HYDROCARBONS, METABOLISM, MARINE ORGANISMS, SUBARCTIC REGIONS, TOXICITY,
2077 BIODEGRADATION, BEAUFORT SEA, HYDROCARBONS, CRUDE OIL, ICE, SEDIMENTS, SEAWATER,
2078 BIODEGRADATION, CRUDE OIL, TOXICITY, ECHINODERMS, *EKOFISK OIL,
2079 BIODEGRADATION, OIL SPILLS, PATENT, *NUTRIENT ADDITION,
2080 BIODEGRADATION, BACTERIA, FUEL OIL, PETROLEUM PRODUCTS, OXIDATION, CASPIAN SEA,
2081 BIODEGRADATION, BACTERIA, HYDROCARBONS, LAKES, WATER QUALITY, WISCONSIN, *NUTRIENT LIMITATION,

2082 BIODEGRADATION, BACTERIA, CRUDE OIL, HYDROCARBONS, SOIL, CANADA, *NUTRIENT ADDITION,
2092 BIODEGRADATION, PETROLEUM PRODUCTS, SURFACTANTS, FATE, SEAWATER, SEDIMENTS, *SELF-PURIFICATION, *SEA OF AZOV,
2093 BIODEGRADATION, AROMATIC HYDROCARBONS , OIL SPILLS, CHEMICAL ANALYSIS, WEATHERING, BIOLOGICAL EFFECTS, FISH, NORWAY, *T/T "DRUPA" SPILL,
2094 BIODEGRADATION, BALTIC SEA, OIL SPILLS, MODELS, FATE, DISTRIBUTION, INTERTIDAL ZONE,
2097 BIODEGRADATION, FATE, HYDROCARBONS, SEAWATER, ECOSYSTEM, SEDIMENTATION, *NAPHTHALENES,
2107 BIODEGRADATION, DECOMPOSITION, FUEL OIL, MICROORGANISMS, *PHYSICOCHEMICAL DEGRADATION,
1639 BIOLOGICAL EFFECTS, OIL SPILLS, REGULATIONS, OIL TRANSFER, BIRDS, SCOTLAND,
1673 BIOLOGICAL EFFECTS, ALASKA, MONITORING, FATE, CRUDE OIL, MOVEMENT, MICROORGANISMS, CHEMICAL EFFECTS, *PERMAFROST TERRAIN,
1794 BIOLOGICAL EFFECTS, ALGAE, RESTORATION, SHORELINES, OIL SPILLS, MOLLUSKS, *ROCKY SHORES, ENGLAND,
1911 BIOLOGICAL EFFECTS, FUEL OIL, BIRDS, *HATCHABILITY, *MALLARD DUCK EGGS,
1915 BIOLOGICAL EFFECTS, AROMATIC HYDROCARBONS , CRUSTACEANS, ESTUARIES, *COPEPOD,
1917 BIOLOGICAL EFFECTS, BIRDS, *SEABIRDS, OIL SPILLS, RESTORATION,
1918 BIOLOGICAL EFFECTS, BIRDS, *SEABIRDS, OIL SPILLS, OIL SLICKS, CHRONIC EFFECTS,
1919 BIOLOGICAL EFFECTS, BACTERIA, CRUDE OIL, FUNGI, ICE, FRESHWATER, *OIL-UNDER-ICE ,
1922 BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, INVERTEBRATES, FISH, FOOD WEB,
1923 BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, FUEL OIL, CANADA, *GEORGIA STRAIT, *HETEROTROPHIC POTENTIAL, *PRODUCTIVITY,
1924 BIOLOGICAL EFFECTS, BEAUFORT SEA, HYDROCARBONS, CRUDE OIL, UPTAKE, MARINE MAMMALS, *RINGED SEAL,
1925 BIOLOGICAL EFFECTS, BIODEGRADATION, HYDROCARBONS, FUEL OIL, MICROORGANISMS, MARSHES, *SALTMARSH,
1927 BIOLOGICAL EFFECTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, BIRDS, SANTA BARBARA CHANNEL,
1928 BIOLOGICAL EFFECTS, MOLLUSKS, *PHENOL, *CYTOLOGY, *MERCENARIA MERCENARIA,
1931 BIOLOGICAL EFFECTS, CRUDE OIL, FISH, *FIN ROT, *MUGIL CEPHALUS,
1932 BIOLOGICAL EFFECTS, DISPERSANTS, SURFACTANTS, FISH, TOXICITY,
1936 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, FISH, HYDROCARBONS, *TISSUES, *MORPHOLOGICAL CHANGES,
1937 BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MARINE ORGANISMS, BIRDS, MOLLUSKS, CHESAPEAKE BAY, *MARSH GRASSES,
1944 BIOLOGICAL EFFECTS, FUEL OIL, OIL SPILLS, CONTAMINATION, MARSHES, CRUSTACEANS, MASSACHUSETTS, *UCA PUGNAX,
1945 BIOLOGICAL EFFECTS, FUEL OIL, METABOLISM, CRUSTACEANS, *TEMPERATURE, *SALINITY, *LIMULUS POLYPHEMUS,
1950 BIOLOGICAL EFFECTS, CORAL REEFS, CONTAMINATION, RED SEA, ISRAEL, *SUCCESSION, *RECOLONIZATION,
1951 BIOLOGICAL EFFECTS, ARCTIC, HYDROCARBONS, MARINE ORGANISMS, ECOSYSTEMS, SUBARCTIC REGIONS,
1952 BIOLOGICAL EFFECTS, OIL SPILLS, FUEL OIL, INVERTEBRATES, FISH, STREAMS, VIRGINIA,
1953 BIOLOGICAL EFFECTS, CRUDE OIL, CRUSTACEANS, *WATER-SOLUBLE FRACTION, *MOLTING LARVAE,
1956 BIOLOGICAL EFFECTS, BALTIC SEA, INTERTIDAL ZONE, SPILL CLEANUP,
1957 BIOLOGICAL EFFECTS, BACTERIA, BIOMASS, SEDIMENTS, MICRCORGANISMS, INTERTIDAL ZONE,
1958 BIOLOGICAL EFFECTS, PHYTOPLANKTON, HYDROCARBONS, METABOLISM, *PLANT GROWTH, *PHOTOSYNTHESIS,
1960 BIOLOGICAL EFFECTS, CRUDE OIL, DISPERSIONS, METABOLISM, CRUSTACEANS, *SUBLETHAL EFFECTS, *ARCTIC AMPHIPOD,
1961 BIOLOGICAL EFFECTS, BENTHOS, POLLUTION CONTROL, COASTS, *PELAGIC ORGANISMS,
1966 BIOLOGICAL EFFECTS, CRUDE OIL, *INSECTS, CANADA, *CHIRONOMID LARVAE,
1969 BIOLOGICAL EFFECTS, ALGAE, PETROLEUM PRODUCTS, FUELS, CRUDE OIL, *GROWTH, *REPRODUCTION, *FUCUS EDENTATUS DE LA PYL,
1971 BIOLOGICAL EFFECTS, METULA SPILL, MARINE ORGANISMS, INTERTIDAL ZONE, MAGELLAN/STRAIT OF,
1973 BIOLOGICAL EFFECTS, FUEL OIL, BIRDS, *HATCHABILITY, *COMMON EIDER EGGS,
1975 BIOLOGICAL EFFECTS, CRUDE OIL, SEAWATER, SEDIMENTS, MOLLUSKS, *WATER-SOLUBLE FRACTION, *OIL-TREATED SEDIMENT, *MACOMA BALTHICA,
1982 BIOLOGICAL EFFECTS, BALTIC SEA, CONTAMINATION,
1983 BIOLOGICAL EFFECTS, DISPERSANTS, FISH, SPILL CLEANUP, *EMBRYO DEVELOPMENT,
1984 BIOLOGICAL EFFECTS, OIL SPILLS, MOLLUSKS, MAINE, *GONADAL NEOPLASMS, *MYA ARENARIA,
1986 BIOLOGICAL EFFECTS, MARINE MAMMALS, CRUDE OIL, *THERMAL CONDUCTANCE, *SEA OTTERS, *PINNIPEDS,
1998 BIOLOGICAL EFFECTS, SOURCES, CONTAMINATION, SHIPS, EXPLORATION , PRODUCTION , SEABIRDS, MARINE ORGANISMS, FISHERIES, SPILL CLEANUP, DISPERSANTS,
2000 BIOLOGICAL EFFECTS, CONTAMINATION, OCEANS, SOURCES, POLLUTION CONTROL, MARINE ORGANISMS, DISPERSANTS,
2006 BIOLOGICAL EFFECTS, BACTERIA, PETROLEUM PRODUCTS, LUBRICATING OIL, MOVEMENT, SOIL,
2008 BIOLOGICAL EFFECTS, HYDROCARBONS, CONTAMINATION, OCEANS, HEALTH HAZARDS, POLLUTION CONTROL,
2037 BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, MARINE MAMMALS, OCS, *MORTALITY,
2056 BIOLOGICAL EFFECTS, DRILLING , *DRILL CUTTINGS, FATE, OCEANS,
2072 BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, GASOLINE, MICROORGANISMS, LAKES,
2093 BIOLOGICAL EFFECTS, BIODEGRADATION, AROMATIC HYDROCARBONS , OIL SPILLS, CHEMICAL

ANALYSIS, WEATHERING, FISH, NORWAY, *T/T "DRUPA" SPILL,
2099 BIOLOGICAL EFFECTS, OIL SPILLS, FATE, DISPERSANTS,
2125 BIOLOGICAL EFFECTS, INTERNATIONAL CONVENTIONS, UN, POLLUTION CONTROL, MONITORING, MEDITERRANEAN SEA,
2127 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, FISH, FRESHWATER,
2128 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, ANIMALS, OIL SPILLS, PLANTS, MICROORGANISMS,
1957 BIOMASS, BIOLOGICAL EFFECTS, BACTERIA, SEDIMENTS, MICROORGANISMS, INTERTIDAL ZONE,
1639 BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, REGULATIONS, OIL TRANSFER, SCOTLAND,
1660 BIRDS, TANKERS, OLYMPIC GAMES SPILL, SPILL CLEANUP, DELAWARE, *DELAWARE RIVER,
1911 BIRDS, BIOLOGICAL EFFECTS, FUEL OIL, *HATCHABILITY, *MALLARD DUCK EGGS,
1917 BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS, OIL SPILLS, RESTORATION,
1918 BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS, OIL SPILLS, OIL SLICKS, CHRONIC EFFECTS,
1927 BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, SANTA BARBARA CHANNEL,
1937 BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MARINE ORGANISMS, MOLLUSKS, CHESAPEAKE BAY, *MARSH GRASSES,
1941 BIRDS, ARGENTINA, CONTAMINATION, COASTS, *TIERRA DEL FUEGO, *PENGUINS, *MORTALITY,
1973 BIRDS, BIOLOGICAL EFFECTS, FUEL OIL, *HATCHABILITY, *COMMON EIDER EGGS,
2002 BIRDS, OIL SPILLS, REFINERIES, OIL TRANSPORT, OFFSHORE PRODUCTION, POLLUTION CONTROL, TOXICITY, FISHERIES, NORTH SEA,
2013 BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, MARINE MAMMALS,
2015 BIRDS, ARCTIC, ALASKA, HABITAT, SHORELINES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, *SHOREBIRD SPECIES,
2016 BIRDS, BASELINE STUDIES, ALASKA, SHORELINES, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS,
1676 BLM, BASELINE STUDIES, ALASKA COAST, MONITORING, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, INFORMATION SYSTEMS, NOAA,
2043 BLM, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS,
1652 BLOWOUT PREVENTION, NORTH SEA, NORWAY, *RED ADAIR CO.,
1664 BLOWOUT PREVENTION, PERSONNEL TRAINING, *BLOWOUT SCHOOL,
1893 BLOWOUT PREVENTION, DRILLING , DESIGN-ENGINEERING, PATENT,
1897 BLOWOUT PREVENTION, POLLUTION CONTROL, *SLIP RINGS, *EQUIPMENT,
1642 BLOWOUTS, POLLUTION CONTROL, NORTH SEA, NORWAY, *EMERGENCY VESSEL,
1644 BLOWOUTS, OIL WELLS, LOUISIANA, *GAS-WELLS,
1645 BLOWOUTS, OIL SPILLS, NORWAY, *PREDICTION,
1744 BLOWOUTS, SPILL RECOVERY, BOOMS, NORTH SEA, NORWAY,
1904 BLOWOUTS, STATISTICAL ANALYSIS, ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS, NORTH SEA,
1732 BOOMS, SPILL CONTAINMENT, HARBORS, INLAND, *PRODUCT INFORMATION,
1733 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, *OILFENCE,
1735 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, *PRODUCT INFORMATION,
1736 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, PATENT, *CONNECTOR HINGE,
1737 BOOMS, SPILL CONTAINMENT, SKIMMERS, DESIGN-ENGINEERING, PATENT,
1738 BOOMS, BEHAVIOR, SPILL CONTAINMENT, OIL SLICKS, *SLICK DROPLET FORMATION, *ENTRAINMENT FAILURE,
1739 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, FRESHWATER, OCEANS,
1740 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, PATENT,
1741 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, *SEABOOM,
1744 BOOMS, BLOWOUTS, SPILL RECOVERY, NORTH SEA, NORWAY,
1750 BOOMS, ABSORPTION, SPILL RECOVERY, SKIMMERS, SHIPS,
1752 BOOMS, DISPERSANTS, OIL SLICKS, SPILL CLEANUP, *PUMPS,
1774 BOOMS, SPILL RECOVERY, PATENT,
1786 BOOMS, SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, PATENT,
1991 CALIFORNIA, OIL SPILLS, INLAND, ECONOMICS, SPILL CLEANUP, RESTORATION,
1722 CALIFORNIA/SOUTHERN, BIODEGRADATION, CHEMICAL ANALYSIS, NATURAL SEEPAGE, WEATHERING, CHROMATOGRAPHY, SPECTROMETRY, SANTA BARBARA CHANNEL,
1885 CALIFORNIA/SOUTHERN, CONTINGENCY PLANNING, OIL INDUSTRY, OIL-GAS LEASING, OCS,
2028 CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS,
2029 CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
2030 CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS,
2031 CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
2032 CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, EIS, ENVIRONMENTAL EFFECTS,
2041 CALIFORNIA/SOUTHERN, OFFSHORE DRILLING, PLATFORMS, UPTAKE, MARINE ORGANISMS, SEDIMENTS,
1636 CANADA, ARCTIC OCEAN, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING,
1646 CANADA, ATLANTIC OCEAN, TAR, OCEANS, DISTRIBUTION, SARGASSO SEA,
1708 CANADA, ATLANTIC COAST, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION,
1754 CANADA, SPILL CLEANUP, SPILL CONTAINMENT, *EQUIPMENT LOCATER SYSTEM,
1630 CANADA, WASTEWATER TREATMENT, INDUSTRIES, OIL-WATER SEPARATION, RECLAMATION, REUSE,
1634 CANADA, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION, REFINERIES, *DUAL-MEDIA FILTERS,
1923 CANADA, BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, FUEL OIL, *GEORGIA STRAIT,

*HETEROTROPHIC POTENTIAL, *PRODUCTIVITY,
1959 CANADA, HYDROCARBONS, METABOLISM, DETECTION, MONITORING, MARINE ORGANISMS, *ENZYME
ACTIVITY,
1966 CANADA, BIOLOGICAL EFFECTS, CRUDE OIL, *INSECTS, *CHIRONOMID LARVAE,
1977 CANADA, OIL SPILLS, TOXICITY, MARINE ORGANISMS, INTERTIDAL ZONE, CHEDABUCTO BAY,
*MORTALITIES,
1992 CANADA, TANKERS, OIL SPILLS, LEGISLATION, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
2034 CANADA, ARCTIC, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
ICE, OIL INDUSTRY,
2036 CANADA, TAR SANDS, DEVELOPMENT , EXTRACTION, ENVIRONMENTAL PROTECTION, *ALBERTA,
2082 CANADA, BIODEGRADATION, BACTERIA, CRUDE OIL, HYDROCARBONS, SOIL, *NUTRIENT ADDITION,
2117 CANADA, GUIDELINES, ENVIRONMENTAL PROTECTION, REFINERIES, WASTEWATER TREATMENT,
*ALBERTA,
2118 CANADA, REGULATIONS, WASTEWATERS, REFINERIES, ENVIRONMENTAL PROTECTION, ECONOMICS,
*QUEBEC,
2119 CANADA, LEGISLATION, LAW ENFORCEMENT, SHIPS, OIL SPILLS, ENGLAND,
2121 CANADA, REGULATIONS, POLLUTION CONTROL, WASTEWATERS, CONTAMINANTS, REFINERIES,
1699 CARCINOGENS, SAMPLING, PAH, DETECTION, MOLLUSKS, ESTUARIES, OREGON, *BIVALVES,
2011 CARCINOGENS, OIL SHALE, EXTRACTION, HEALTH HAZARDS, *BENZO(A)PYRENE,
2136 CARIBBEAN SEA, BIBLIOGRAPHIES, CONTAMINATION, MARINE ORGANISMS,
1720 CASPIAN SEA, ANALYTICAL TECHNIQUES, CONTAMINATION, *OPTICAL EMISSION, *SEA SURFACE,
2060 CASPIAN SEA, BIODEGRADATION, BACTERIA, FUEL OIL, PETROLEUM PRODUCTS, OXIDATION,
1977 CHEDABUCTO BAY, CANADA, OIL SPILLS, TOXICITY, MARINE ORGANISMS, INTERTIDAL ZONE,
*MORTALITIES,
1670 CHEMICAL ANALYSIS, MONITORING, OIL SPILLS, WASTE OIL, *IR ABSORPTION ,
1690 CHEMICAL ANALYSIS, REMOTE SENSING, PETROLEUM PRODUCTS, DETECTION, SPECTROSCOPY,
*COMPUTERIZED RAMAN SPECTROSCOPY ,
1698 CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS, SEAWATER, OIL-GAS LEASING, MEXICO/GULF OF,
*SEASONAL VARIATIONS, *MAFLA LEASE AREA,
1703 CHEMICAL ANALYSIS, OIL SLICKS, PETROLEUM PRODUCTS, SEAWATER, *SORBENTS,
1704 CHEMICAL ANALYSIS, SEDIMENTS, OFFSHORE PRODUCTION, VENEZUELA, STATISTICAL ANALYSIS,
1705 CHEMICAL ANALYSIS, HYDROCARBONS, FUEL OIL, SEAWATER, CHROMATOGRAPHY, *WATER-SOLUBLE
FRACTION,
1707 CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , SEAWATER, *ELECTROCHEMICAL ANALYSIS ,
1708 CHEMICAL ANALYSIS, CANADA, ATLANTIC COAST, HYDROCARBONS, CHROMATOGRAPHY, SPECTROSCOPY,
DETECTION,
1709 CHEMICAL ANALYSIS, HYDROCARBONS, SURFACTANTS, DETECTION, CONTAMINANTS, ENVIRONMENTAL
PROTECTION,
1710 CHEMICAL ANALYSIS, HYDROCARBONS, CHROMATOGRAPHY, SPECTROMETRY, ZOOPLANKTON,
CRUSTACEANS, SEDIMENTS,
1712 CHEMICAL ANALYSIS, SOURCES, CONTAMINATION, FISH, PETROLEUM PRODUCTS, GREAT LAKES ,
1714 CHEMICAL ANALYSIS, BASELINE STUDIES, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION,
HYDROCARBONS, MARINE ORGANISMS,
1715 CHEMICAL ANALYSIS, SOURCES, HYDROCARBONS, MARINE ORGANISMS, CHROMATOGRAPHY,
SPECTROSCOPY, SPECTROMETRY,
1717 CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , CHROMATOGRAPHY, HYDROCARBONS, MONITORING,
SEDIMENTS, *GLASS CAPILLARY COLUMNS,
1718 CHEMICAL ANALYSIS, *OIL IN WATER ,
1719 CHEMICAL ANALYSIS, DISPERSANTS, SURFACTANTS,
1721 CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, SOIL,
1722 CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, BIODEGRADATION, NATURAL SEEPAGE, WEATHERING,
CHROMATOGRAPHY, SPECTROMETRY, SANTA BARBARA CHANNEL,
1723 CHEMICAL ANALYSIS, OIL SPILLS, SOURCE IDENTIFICATION,
1726 CHEMICAL ANALYSIS, ADSORPTION, PETROLEUM PRODUCTS, HYDROCARBONS, SEAWATER,
SURFACTANTS, *ELECTROANALYSIS ,
1846 CHEMICAL ANALYSIS, WASTEWATER TREATMENT, REFINERIES, EPA, *ANALYTICAL VARIABILITY,
2004 CHEMICAL ANALYSIS, DETECTION, SPILL CLEANUP,
2026 CHEMICAL ANALYSIS, PETROCHEMICALS, WASTEWATER TREATMENT, POLLUTION CONTROL, NORWAY,
2038 CHEMICAL ANALYSIS, BASELINE STUDIES, ATLANTIC COAST, OCS, OFFSHORE DEVELOPMENT,
HYDROCARBONS,
2093 CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BIODEGRADATION, AROMATIC HYDROCARBONS , OIL
SPILLS, WEATHERING, FISH, NORWAY, *T/T "DRUPA" SPILL,
2135 CHEMICAL ANALYSIS, BIBLIOGRAPHIES, DETECTION, SAMPLING, MONITORING, REMOTE SENSING,
1673 CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA, MONITORING, FATE, CRUDE OIL, MOVEMENT,
MICROORGANISMS, *PERMAFROST TERRAIN,
1668 CHESAPEAKE BAY, ARGO MERCHANT SPILL, MONITORING,
1937 CHESAPEAKE BAY, BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MARINE ORGANISMS,
MOLLUSKS, *MARSH GRASSES,
1677 CHROMATOGRAPHY, MONITORING, SOURCE IDENTIFICATION, DESIGN-ENGINEERING, *INSTRUMENT
SURVEY,
1705 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, FUEL OIL, SEAWATER, *WATER-SOLUBLE
FRACTION,
1708 CHROMATOGRAPHY, CHEMICAL ANALYSIS, CANADA, ATLANTIC COAST, HYDROCARBONS, SPECTROSCOPY,
DETECTION,
1710 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SPECTROMETRY, ZOOPLANKTON,

CRUSTACEANS, SEDIMENTS,
1711 CHROMATOGRAPHY, BEACHES, ANALYTICAL TECHNIQUES, ABSORPTION, HYDROCARBONS, SEAWATER, SPECTROSCOPY,
1714 CHROMATOGRAPHY, CHEMICAL ANALYSIS, BASELINE STUDIES, SPECTROSCOPY, DETECTION, HYDROCARBONS, MARINE ORGANISMS,
1715 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, HYDROCARBONS, MARINE ORGANISMS, SPECTROSCOPY, SPECTROMETRY,
1717 CHROMATOGRAPHY, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , HYDROCARBONS, MONITORING, SEDIMENTS, *GLASS CAPILLARY COLUMNS,
1722 CHROMATOGRAPHY, CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, BIODEGRADATION, NATURAL SEEPAGE, WEATHERING, SPECTROMETRY, SANTA BARBARA CHANNEL,
1725 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEDIMENTS, SPECTROSCOPY, *INTERCALIBRATION,
1672 CHRONIC EFFECTS, AUSTRALIA, MONITORING, HYDROCARBONS, SOURCES, DISTRIBUTION, *MYTILUS EDULIS, *INDICATOR SPECIES,
1918 CHRONIC EFFECTS, BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS, OIL SPILLS, OIL SLICKS,
1938 CHRONIC EFFECTS, CRUDE OIL, TOXICITY, FISH, *TROUT REPRODUCTION,
1939 CHRONIC EFFECTS, AEGEAN SEA, CONTAMINATION, PHYTOPLANKTON,
1949 CHRONIC EFFECTS, TOXICITY, FISH, FRESHWATER, LUBRICATING OIL, *SYNTHETIC OIL,
2005 CHRONIC EFFECTS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, CONTAMINATION, OIL SPILLS,
1814 COALESCENCE, WASTEWATER TREATMENT, EMULSIONS, WASTE OIL,
1815 COALESCENCE, OIL-WATER SEPARATION, SHIPS, FLOTATION, DESIGN-ENGINEERING, PATENT,
1826 COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, PATENT, *CELLULOSE PULP,
1838 COALESCENCE, OIL-WATER SEPARATION, PATENT, *ULTRASONICS,
1839 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1841 COALESCENCE, OIL-WATER SEPARATION, WASTEWATER TREATMENT, DESIGN-ENGINEERING, *GRAVITY SEPARATION ,
1862 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, WASTEWATERS,
1871 COALESCENCE, WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION,
1873 COALESCENCE, WASTE OIL, LUBRICATING OIL, RECYCLING, FILTRATION,
1656 COASTS, URQUIOLA SPILL, FATE, POLLUTION CONTROL, SPILL CLEANUP, SPAIN,
1657 COASTS, ALASKA, OIL SPILLS, OCEANS, STATISTICS,
1691 COASTS, REMOTE SENSING, OIL SLICKS, DETECTION, MONITORING, NATURAL SEEPAGE, *LANDSAT DATA,
1695 COASTS, REMOTE SENSING, OIL SLICKS, MOVEMENT, WASTEWATERS, *CURRENT CIRCULATION, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1791 COASTS, BEACHES, ABSORPTION, SPILL CLEANUP, DISPERSANTS, DISPOSAL , MARSHES, SEAWATER, FRESHWATER,
1941 COASTS, BIRDS, ARGENTINA, CONTAMINATION, *TIERRA DEL FUEGO, *PENGUINS, *MORTALITY,
1961 COASTS, BIOLOGICAL EFFECTS, BENTHOS, POLLUTION CONTROL, *PELAGIC ORGANISMS,
2001 COASTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, DISTRIBUTION, ENVIRONMENTAL EFFECTS,
2042 COASTS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, CONTAMINANTS, FISH,
2046 COASTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL MANAGEMENT, GUIDELINES, *CZM,
2049 COASTS, CONTAMINATION, ESTUARIES, DEVELOPMENT , OIL INDUSTRY,
2052 COASTS, OFFSHORE DEVELOPMENT, OCS, ONSHORE IMPACTS, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION,
2053 COASTS, OIL INDUSTRY, ENVIRONMENTAL MANAGEMENT, LOUISIANA, LEGISLATION, US,
2055 COASTS, OFFSHORE DEVELOPMENT, OCS, US, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, STATE GOVERNMENTS,
2109 COASTS, LEGISLATION, US, OCS, OFFSHORE DEVELOPMENT, REFINERIES, ENVIRONMENTAL EFFECTS,
1659 COMPENSATION, LEGISLATION, NEW JERSEY, SPILL CLEANUP, OIL INDUSTRY, *SPILL FUND,
1966 COMPENSATION, LEGISLATION, LIABILITY, TANKERS, OIL SPILLS, OIL INDUSTRY, *SPILL SUPERFUNDS,
2106 COMPENSATION, LEGISLATION, US, OIL SPILLS, LIABILITY, SPILL CLEANUP, *COSTS,
1667 CONTAMINANTS, ANALYTICAL TECHNIQUES, MONITORING, SAMPLING,
1692 CONTAMINANTS, REMOTE SENSING, ENVIRONMENTAL EFFECTS, MONITORING, OIL SPILLS,
1709 CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS, SURFACTANTS, DETECTION, ENVIRONMENTAL PROTECTION,
1763 CONTAMINANTS, ABSORPTION, PATENT, *OIL-ABSORBENT COMPOUND,
1816 CONTAMINANTS, WASTEWATER TREATMENT, REFINERIES, EXTRACTION, SOLVENTS,
1818 CONTAMINANTS, CRUDE OIL, INDUSTRIES, DISPOSAL , GROUNDWATER, ENVIRONMENTAL EFFECTS,
1855 CONTAMINANTS, REFINERIES, WASTEWATERS, SOLID WASTES, DISPOSAL , INLAND, *WASTE DISPOSAL PRACTICES, *LANDFILLS,
2007 CONTAMINANTS, FUELS, PRODUCTION , ENVIRONMENTAL EFFECTS,
2042 CONTAMINANTS, COASTS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, FISH,
2121 CONTAMINANTS, CANADA, REGULATIONS, POLLUTION CONTROL, WASTEWATERS, REFINERIES,
1702 CONTAMINATION, OCEANS, PETROLEUM PRODUCTS, *LASER RADAR, *SEA SURFACE,
1712 CONTAMINATION, CHEMICAL ANALYSIS, SOURCES, FISH, PETROLEUM PRODUCTS, GREAT LAKES ,
1720 CONTAMINATION, CASPIAN SEA, ANALYTICAL TECHNIQUES, *OPTICAL EMISSION, *SEA SURFACE,
1729 CONTAMINATION, SOURCE IDENTIFICATION, GROUNDWATER, OIL WELLS, PRODUCTION , WASTEWATERS, *BRINE DISPOSAL,
1759 CONTAMINATION, ADSORPTION, FUEL OIL, FRESHWATER, *ACTIVATED CARBON, *WATER SUPPLY,
1765 CONTAMINATION, ABSORPTION, OIL TANKS, PATENT, *CLEANUP ,
1793 CONTAMINATION, RESTORATION, VEGETATION, MARSHES, WASTEWATERS, REFINERIES, ENGLAND,

*SALT MARSH,
1930 CONTAMINATION, PLANTS, CRUDE OIL, TOXICITY, *OLNEY BULRUSH, *MARSHHAY CORDGRASS,
1939 CONTAMINATION, CHRONIC EFFECTS, AEGEAN SEA, PHYTOPLANKTON,
1941 CONTAMINATION, COASTS, BIRDS, ARGENTINA, *TIERRA DEL FUEGO, *PENGUINS, *MORTALITY,
1944 CONTAMINATION, BIOLOGICAL EFFECTS, FUEL OIL, OIL SPILLS, MARSHES, CRUSTACEANS,
MASSACHUSETTS, *UCA PUGNAX,
1950 CONTAMINATION, BIOLOGICAL EFFECTS, CORAL REEFS, RED SEA, ISRAEL, *SUCCESSION,
*RECOLONIZATION,
1954 CONTAMINATION, FISH, CRUDE OIL, ESTUARIES, *FIN ROT, *MULLET,
1967 CONTAMINATION, ATLANTIC COAST, OIL DISCHARGES, HYDROCARBONS, PHYTOPLANKTON, OCS,
1982 CONTAMINATION, BIOLOGICAL EFFECTS, BALTIC SEA,
1998 CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SHIPS, EXPLORATION , PRODUCTION ,
SEABIRDS, MARINE ORGANISMS, FISHERIES, SPILL CLEANUP, DISPERSANTS,
2000 CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, SOURCES, POLLUTION CONTROL, MARINE
ORGANISMS, DISPERSANTS,
2005 CONTAMINATION, CHRONIC EFFECTS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
OIL SPILLS,
2008 CONTAMINATION, BIOLOGICAL EFFECTS, HYDROCARBONS, OCEANS, HEALTH HAZARDS, POLLUTION
CONTROL,
2009 CONTAMINATION, FISHERIES, *SHELLFISH , ENVIRONMENTAL EFFECTS,
2035 CONTAMINATION, GROUNDWATER, DRILLING , OIL WELLS, *DRILLING FLUIDS, *WELL COMPLETION,
2049 CONTAMINATION, COASTS, ESTUARIES, DEVELOPMENT , OIL INDUSTRY,
2105 CONTAMINATION, FATE, SEAWATER, SPREADING, EVAPORATION, OXIDATION, SOLUTION,
DISPERSIONS,
2136 CONTAMINATION, CARIBBEAN SEA, BIBLIOGRAPHIES, MARINE ORGANISMS,
1638 CONTINGENCY PLANNING, CANADA, ARCTIC OCEAN, ENVIRONMENTAL PROTECTION,
1757 CONTINGENCY PLANNING, SPILL RECOVERY, *RESPONSE TEAMS, US,
1883 CONTINGENCY PLANNING, PERSONNEL TRAINING, OIL SPILLS, POLLUTION CONTROL, *OIL SPILL
CONTROL COURSE,
1885 CONTINGENCY PLANNING, CALIFORNIA/SOUTHERN, OIL INDUSTRY, OIL-GAS LEASING, OCS,
1886 CONTINGENCY PLANNING, SPILL CLEANUP, USCG, EPA,
1887 CONTINGENCY PLANNING, SPILL CLEANUP, PERSONNEL TRAINING, UK, US, EUROPE,
1898 CONTINGENCY PLANNING, SPILL CLEANUP, PUGET SOUND, OIL INDUSTRY, *OIL SPILL COOPERATIVE,
2122 CONTINGENCY PLANNING, MANUALS, POLLUTION PREVENTION, GUIDELINES, TANKERS,
1950 CORAL REEFS, CONTAMINATION, BIOLOGICAL EFFECTS, RED SEA, ISRAEL, *SUCCESSION,
*RECOLONIZATION,
1635 COST ANALYSIS, EKOFISK BLOWOUT, OFFSHORE DRILLING, OFFSHORE EXPLORATION, NORWAY,
1769 COST ANALYSIS, ABSORPTION, SPILL RECOVERY, *SORBENTS, *PERFORMANCE EVALUATION,
1861 COST ANALYSIS, WASTEWATER TREATMENT, CRUDE OIL, REFINERIES, ECONOMICS, USSR,
1987 COST ANALYSIS, API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL, WASTEWATER
TREATMENT, REFINERIES,
1990 COST ANALYSIS, API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL, ECONOMIC EFFECTS,
EPA,
2018 COST ANALYSIS, OIL INDUSTRY, REGULATIONS, US, WATER QUALITY, POLLUTION PREVENTION,
2019 COST ANALYSIS, OIL INDUSTRY, REGULATIONS, POLLUTION PREVENTION, ECONOMIC EFFECTS,
1634 CRUDE OIL, OIL SPILLS, FATE, EKOFISK BLOWOUT,
1651 CRUDE OIL, ALASKA, OIL SPILLS, PIPELINES, *PUMP STATION ACCIDENT,
1653 CRUDE OIL, ALASKA, OIL SPILLS, PIPELINES, *PUMP STATION ACCIDENT,
1673 CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA, MONITORING, FATE, MOVEMENT,
MICROORGANISMS, *PERMAFROST TERRAIN,
1693 CRUDE OIL, REMOTE SENSING, PETROLEUM PRODUCTS, DETECTION, *SEA SURFACE, *RADAR,
1724 CRUDE OIL, ANALYTICAL TECHNIQUES, FUEL OIL, *OIL-GREASE DETERMINATION,
1727 CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, FUEL OIL, PETROLEUM PRODUCTS,
SPECTROSCOPY,
1795 CRUDE OIL, TANKERS, STORAGE, ENVIRONMENTAL PROTECTION, FEA,
1797 CRUDE OIL, ALASKA, OIL TRANSPORT, PIPELINES, TEXAS, EIS, OIL SPILLS,
1798 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, *SALT DOMES, OIL TANKS, *STRATEGIC
PETROLEUM RESERVE,
1799 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, *SALT DOMES, *MINES, *STRATEGIC
PETROLEUM RESERVE,
1800 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
1818 CRUDE OIL, CONTAMINANTS, INDUSTRIES, DISPOSAL , GROUNDWATER, ENVIRONMENTAL EFFECTS,
1824 CRUDE OIL, OIL-WATER SEPARATION, EMULSIONS, PATENT,
1831 CRUDE OIL, EMULSIONS, OIL-WATER SEPARATION, PATENT,
1852 CRUDE OIL, EMULSIONS, OIL-WATER SEPARATION,
1861 CRUDE OIL, COST ANALYSIS, WASTEWATER TREATMENT, REFINERIES, ECONOMICS, USSR,
1875 CRUDE OIL, SPILL RECOVERY, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FUELS,
1914 CRUDE OIL, ALGAE, TOXICITY, FUEL OIL,
1919 CRUDE OIL, BIOLOGICAL EFFECTS, BACTERIA, FUNGI, ICE, FRESHWATER, *OIL-UNDER-ICE ,
1920 CRUDE OIL, AROMATIC HYDROCARBONS , TOXICITY, CRUSTACEANS, *LARVAL DEVELOPMENT, *CANCER
MAGISTER,
1921 CRUDE OIL, FUEL OIL, TOXICITY, POLYCHAETES, *REPRODUCTION,
1923 CRUDE OIL, CANADA, BIOLOGICAL EFFECTS, MICROORGANISMS, FUEL OIL, *GEORGIA STRAIT,
*HETEROTROPHIC POTENTIAL, *PRODUCTIVITY,
1924 CRUDE OIL, BIOLOGICAL EFFECTS, BEAUFORT SEA, HYDROCARBONS, UPTAKE, MARINE MAMMALS,

*RINGED SEAL,
1926 CRUDE OIL, TOXICITY, CRUSTACEANS, *MISSISSIPPI SOUND, *COPEPODS,
1929 CRUDE OIL, UPTAKE, RELEASE, MOLLUSKS, *NAPHTHALENES, *RANGEA CUNEATA, *PROTOTHACA STAMINEA,
1930 CRUDE OIL, CONTAMINATION, PLANTS, TOXICITY, *OLNEY BULRUSH, *MARSHHAY CORDGRASS,
1931 CRUDE OIL, BIOLOGICAL EFFECTS, FISH, *FIN ROT, *MUGIL CEPHALUS,
1938 CRUDE OIL, CHRONIC EFFECTS, TOXICITY, FISH, *TROUT REPRODUCTION,
1940 CRUDE OIL, BENTHOS, TOXICITY, PLANKTON , OCS, *NEW YORK BIGHT, NEW YORK,
1948 CRUDE OIL, TOXICITY, PHYTOPLANKTON, ESTUARIES, *KUWAIT CRUDE,
1953 CRUDE OIL, BIOLOGICAL EFFECTS, CRUSTACEANS, *WATER-SOLUBLE FRACTION, *MOLTING LARVAE,
1954 CRUDE OIL, CONTAMINATION, FISH, ESTUARIES, *FIN ROT, *MULLET,
1955 CRUDE OIL, BIODEGRADATION, BACTERIA, ALGAE, PETROLEUM PRODUCTS, GASOLINE, TOXICITY, FRESHWATER, *PHOTOSYNTHESIS,
1960 CRUDE OIL, BIOLOGICAL EFFECTS, DISPERSIONS, METABOLISM, CRUSTACEANS, *SUBLETHAL EFFECTS, *ARCTIC AMPHIPOD,
1962 CRUDE OIL, FUEL OIL, TOXICITY, UPTAKE, RELEASE, MARINE ORGANISMS,
1963 CRUDE OIL, FUEL OIL, TOXICITY, HYDROCARBONS, METABOLISM, FISH,*RESPIRATION, *ONCORHYNCHUS GORBUSCHA,
1964 CRUDE OIL, TOXICITY, MARINE ORGANISMS, PETROLEUM PRODUCTS, *COMPARATIVE TOXICITY , *BIOASSAY,
1965 CRUDE OIL, BIBLIOGRAPHIES, HYDROCARBONS, TOXICITY, MOLLUSKS, SURFACTANTS, EMULSIFIERS, *MUSSELS,
1966 CRUDE OIL, CANADA, BIOLOGICAL EFFECTS, *INSECTS, *CHIRONOMID LARVAE,
1969 CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, PETROLEUM PRODUCTS, FUELS, *GROWTH, *REPRODUCTION, *FUCUS EDENTATUS DE LA PYL,
1975 CRUDE OIL, BIOLOGICAL EFFECTS, SEAWATER, SEDIMENTS, MOLLUSKS, *WATER-SOLUBLE FRACTION, *OIL-TREATED SEDIMENT, *MACOMA BALTHICA,
1980 CRUDE OIL, ARCTIC, TOXICITY, PHYTOPLANKTON, FRESHWATER, *PRIMARY PRODUCTION,
1986 CRUDE OIL, BIOLOGICAL EFFECTS, MARINE MAMMALS, *THERMAL CONDUCTANCE, *SEA OTTERS, *PINNIPEDS,
2003 CRUDE OIL, AROMATIC HYDROCARBONS , OFFSHORE DEVELOPMENT, FISHERIES, NORTH SEA,
2022 CRUDE OIL, ALASKA, OFFSHORE DRILLING, SOCIO-ECONOMIC EFFECTS, OCS, *SEA GRANT PROGRAM, *ENERGY POLICY,
2045 CRUDE OIL, ALASKA, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, OIL-GAS LEASING,
2058 CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, ARCTIC, MICROORGANISMS,
2059 CRUDE OIL, BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, PATENT, *NUTRIENT ADDITION,
2067 CRUDE OIL, BIODEGRADATION, OXIDATION, UPTAKE, *TEMPERATURE EFFECTS,
2073 CRUDE OIL, BIODEGRADATION, BACTERIA, DISPERSANTS,
2077 CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, HYDROCARBONS, ICE, SEDIMENTS, SEAWATER,
2078 CRUDE OIL, BIODEGRADATION, TOXICITY, ECHINODERMS, *EKOFISK OIL,
2082 CRUDE OIL, CANADA, BIODEGRADATION, BACTERIA, HYDROCARBONS, SOIL, *NUTRIENT ADDITION,
2084 CRUDE OIL, EMULSIONS, PHYSICAL EFFECTS, *SUSPENDED SOLIDS, *STABILITY,
2100 CRUDE OIL, ADSORPTION, HYDROCARBONS, SOIL, *DESORPTION, *ORGANIC MATTER CONTENT,
1710 CRUSTACEANS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SPECTROMETRY, ZOOPLANKTON, SEDIMENTS,
1915 CRUSTACEANS, BIOLOGICAL EFFECTS, AROMATIC HYDROCARBONS , ESTUARIES, *COPEPOD,
1920 CRUSTACEANS, CRUDE OIL, AROMATIC HYDROCARBONS , TOXICITY, *LARVAL DEVELOPMENT, *CANCER MAGISTER,
1926 CRUSTACEANS, CRUDE OIL, TOXICITY, *MISSISSIPPI SOUND, *COPEPODS,
1935 CRUSTACEANS, HYDROCARBONS, PLANKTON , UPTAKE, RELEASE, *14C-1-NAPHTHALENE, *COPEPODS,
1944 CRUSTACEANS, CONTAMINATION, BIOLOGICAL EFFECTS, FUEL OIL, OIL SPILLS, MARSHES, MASSACHUSETTS, *UCA PUGNAX,
1945 CRUSTACEANS, BIOLOGICAL EFFECTS, FUEL OIL, METABOLISM, *TEMPERATURE, *SALINITY, *LIMULUS POLYPHEMUS,
1953 CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, *WATER-SOLUBLE FRACTION, *MOLTING LARVAE,
1960 CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, DISPERSIONS, METABOLISM, *SUBLETHAL EFFECTS, *ARCTIC AMPHIPOD,
1974 CRUSTACEANS, HYDROCARBONS, FUEL OIL, UPTAKE, METABOLISM, *NAPHTHALENES, *HATCHING, *LARVAL GROWTH, *GRASS SHRIMP,
2107 DECOMPOSITION, BIODEGRADATION, FUEL OIL, MICROORGANISMS, *PHYSICOCHEMICAL DEGRADATION,
1660 DELAWARE, BIRDS, TANKERS, OLYMPIC GAMES SPILL, SPILL CLEANUP, *DELAWARE RIVER,
2048 DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS, ENVIRONMENTAL EFFECTS, FISHERIES, NEW JERSEY,
2087 DELAWARE BAY, OIL SPILLS, MODELS, WEATHERING, EVAPORATION, OIL TRANSFER,
1669 DESIGN-ENGINEERING, MONITORING, POLLUTION CONTROL,
1674 DESIGN-ENGINEERING, MONITORING, OIL SPILLS, DETECTION, *BUOYS, *GAS SENSORS,
1677 DESIGN-ENGINEERING, CHROMATOGRAPHY, MONITORING, SOURCE IDENTIFICATION, *INSTRUMENT SURVEY,
1680 DESIGN-ENGINEERING, MONITORING, OIL DISCHARGES, TANKERS, REGULATIONS, PATENT,
1684 DESIGN-ENGINEERING, BILGES, MONITORING, SHIPS, DETECTION,
1685 DESIGN-ENGINEERING, BILGES, MONITORING, *TOTAL ORGANIC CARBON DETERMINATION,
1733 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, *OILFENCE,
1735 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, *PRODUCT INFORMATION,
1736 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT, *CONNECTOR HINGE,
1737 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, SKIMMERS, PATENT,

1739 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, FRESHWATER, OCEANS,
1740 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT,
1741 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, *SEABOOM,
1742 DESIGN-ENGINEERING, SPILL RECOVERY, OIL TRANSPORT, *DRACONE BARGE,
1743 DESIGN-ENGINEERING, ABSORPTION, SPILL RECOVERY, USN, *FOAM CHIPS,
1747 DESIGN-ENGINEERING, SPILL RECOVERY, RECLAMATION,
1748 DESIGN-ENGINEERING, SKIMMERS, SPILL RECOVERY,
1751 DESIGN-ENGINEERING, SPILL RECOVERY, NORTH SEA, *OIL COLLECTION SYSTEMS,
1753 DESIGN-ENGINEERING, SPILL CLEANUP, *OIL-SPILL PUMP,
1755 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, *SKIMJET,
1756 DESIGN-ENGINEERING, SKIMMERS, SPILL RECOVERY,
1758 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, *SEAWARD INTERNATIONAL,
1761 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, *FAST CURRENT OIL RECOVERY ,
1762 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT,
1767 DESIGN-ENGINEERING, SPILL RECOVERY, *LOCKHEED DISC-DRUM DEVICE, *PERFORMANCE,
1772 DESIGN-ENGINEERING, DISPERSIONS, OIL-WATER SEPARATION, SPILL CLEANUP, PATENT,
1775 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS,
1779 DESIGN-ENGINEERING, OIL SLICKS, DISPERSANTS, SPILL CLEANUP, PATENT,
1785 DESIGN-ENGINEERING, OIL SLICKS, SPILL RECOVERY, PATENT,
1786 DESIGN-ENGINEERING, BOOMS, SPILL RECOVERY, SKIMMERS, PATENT,
1788 DESIGN-ENGINEERING, OIL SLICKS, SPILL RECOVERY, SKIMMERS, SHIPS, PATENT,
1796 DESIGN-ENGINEERING, STORAGE, TANKERS, PATENT, *OIL STORAGE TANK,
1805 DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, FLOTATION,
1809 DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, PATENT, *COLLECTION RESERVOIR,
1815 DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, SHIPS, FLOTATION, PATENT,
1827 DESIGN-ENGINEERING, OIL-WATER SEPARATION, SLUDGE, GASOLINE, WASTEWATERS, PATENT,
1839 DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1841 DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *GRAVITY SEPARATION ,
1844 DESIGN-ENGINEERING, WASTEWATER TREATMENT, REFINERIES, FILTRATION, SOLID WASTES, OHIO, *UPFLOW SAND FILTERS,
1845 DESIGN-ENGINEERING, OIL-WATER SEPARATION, SKIMMERS, FLOTATION, PATENT,
1860 DESIGN-ENGINEERING, WASTE OIL TREATMENT, EMULSIONS, REFINERIES,
1868 DESIGN-ENGINEERING, POLLUTION PREVENTION, OFFSHORE DRILLING, EMULSIONS, *DRILLING MUDS,
1893 DESIGN-ENGINEERING, BLOWOUT PREVENTION, DRILLING , PATENT,
1895 DESIGN-ENGINEERING, PIPELINES, LEAKAGE, POLLUTION PREVENTION, PATENT,
1901 DESIGN-ENGINEERING, LEAKAGE, PIPELINES, DETECTION, PATENT,
1674 DETECTION, DESIGN-ENGINEERING, MONITORING, OIL SPILLS, *BUOYS, *GAS SENSORS,
1683 DETECTION, MONITORING, DISPERSIONS, PATENT, *OIL SOLUBLE DYE,
1684 DETECTION, DESIGN-ENGINEERING, BILGES, MONITORING, SHIPS,
1686 DETECTION, MONITORING, LEAKAGE, PIPELINES,
1690 DETECTION, CHEMICAL ANALYSIS, REMOTE SENSING, PETROLEUM PRODUCTS, SPECTROSCOPY, *COMPUTERIZED RAMAN SPECTROSCOPY ,
1691 DETECTION, COASTS, REMOTE SENSING, OIL SLICKS, MONITORING, NATURAL SEEPAGE, *LANDSAT DATA,
1693 DETECTION, CRUDE OIL, REMOTE SENSING, PETROLEUM PRODUCTS, *SEA SURFACE, *RADAR,
1694 DETECTION, REMOTE SENSING, OIL SLICKS, SURVEILLANCE, NATURAL SEEPAGE, SANTA BARBARA CHANNEL, *COASTAL ZONE COLOR SCANNER,
1699 DETECTION, CARCINOGENS, SAMPLING, PAH, MOLLUSKS, ESTUARIES, OREGON, *BIVALVES,
1701 DETECTION, ANALYTICAL TECHNIQUES, OIL-WATER SEPARATION, PATENT, *OIL-IN-WATER, *FLUORESCENCE,
1708 DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CANADA, ATLANTIC COAST, HYDROCARBONS, SPECTROSCOPY,
1709 DETECTION, CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS, SURFACTANTS, ENVIRONMENTAL PROTECTION,
1714 DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BASELINE STUDIES, SPECTROSCOPY, HYDROCARBONS, MARINE ORGANISMS,
1894 DETECTION, LEAKAGE, PIPELINES, PATENT,
1899 DETECTION, PRODUCTION , POLLUTION PREVENTION, OIL SPILLS, LEAKAGE, PIPELINES,
1901 DETECTION, DESIGN-ENGINEERING, LEAKAGE, PIPELINES, PATENT,
1959 DETECTION, CANADA, HYDROCARBONS, METABOLISM, MONITORING, MARINE ORGANISMS, *ENZYME ACTIVITY,
2004 DETECTION, CHEMICAL ANALYSIS, SPILL CLEANUP,
2135 DETECTION, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SAMPLING, MONITORING, REMOTE SENSING,
2036 DEVELOPMENT , CANADA, TAR SANDS, EXTRACTION, ENVIRONMENTAL PROTECTION, *ALBERTA,
2049 DEVELOPMENT , CONTAMINATION, COASTS, ESTUARIES, OIL INDUSTRY,
2129 DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS,
2130 DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS,
2131 DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
2132 DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
1650 DISPERSANTS, SPILL CLEANUP, UK, *OIL SPILL POLICY,
1666 DISPERSANTS, FISH, TOXICITY, TROPICAL REGIONS, JAPAN, *WARREN SPRINGS LABORATORY, *HONG KONG,

1719 DISPERSANTS, CHEMICAL ANALYSIS, SURFACTANTS,
1746 DISPERSANTS, SPILL CLEANUP, EMULSIFIERS, SOLUTION, TOXICITY,
1752 DISPERSANTS, BOOMS, OIL SLICKS, SPILL CLEANUP, *PUMPS,
1770 DISPERSANTS, SPILL CLEANUP, TOXICITY, SINKING AGENTS,
1773 DISPERSANTS, SPILL CLEANUP, PATENT, *MAGNETIC POWDER,
1779 DISPERSANTS, DESIGN-ENGINEERING, OIL SLICKS, SPILL CLEANUP, PATENT,
1783 DISPERSANTS, BEACHES, SPILL RECOVERY, SURFACTANTS, PATENT,
1791 DISPERSANTS, COASTS, BEACHES, ABSORPTION, SPILL CLEANUP, DISPOSAL , MARSHES, SEAWATER, FRESHWATER,
1907 DISPERSANTS, SPILL CLEANUP, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
1916 DISPERSANTS, SPILL CLEANUP, OIL DISCHARGES, TOXICITY, MARINE ORGANISMS,
1932 DISPERSANTS, BIOLOGICAL EFFECTS, SURFACTANTS, FISH, TOXICITY,
1934 DISPERSANTS, TOXICITY, ECHINODERMS, *ESSO COREXIT 9527, *FERTILIZATION,
1963 DISPERSANTS, BIOLOGICAL EFFECTS, FISH, SPILL CLEANUP, *EMBRYO DEVELOPMENT,
1996 DISPERSANTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, SHORELINES, INTERTIDAL ZONE, MARINE ORGANISMS, TOXICITY,
1998 DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SHIPS, EXPLORATION , PRODUCTION , SEABIRDS, MARINE ORGANISMS, FISHERIES, SPILL CLEANUP,
2000 DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, SOURCES, POLLUTION CONTROL, MARINE ORGANISMS,
2010 DISPERSANTS, OIL SLICKS, PHYTOPLANKTON, ENVIRONMENTAL EFFECTS, TOXICITY, *LIGHT REDUCTION, *PHOTOSYNTHESIS,
2073 DISPERSANTS, CRUDE OIL, BIODEGRADATION, BACTERIA,
2099 DISPERSANTS, BIOLOGICAL EFFECTS, OIL SPILLS, FATE,
1663 DISPERSIONS, DETECTION, MONITORING, PATENT, *OIL SOLUBLE DYE,
1772 DISPERSIONS, DESIGN-ENGINEERING, OIL-WATER SEPARATION, SPILL CLEANUP, PATENT,
1960 DISPERSIONS, CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, METABOLISM, *SUBLETHAL EFFECTS, *ARCTIC AMPHIPOD,
2105 DISPERSIONS, CONTAMINATION, FATE, SEAWATER, SPREADING, EVAPORATION, OXIDATION, SOLUTION,
1791 DISPOSAL , DISPERSANTS, COASTS, BEACHES, ABSORPTION, SPILL CLEANUP, MARSHES, SEAWATER, FRESHWATER,
1618 DISPOSAL , CRUDE OIL, CONTAMINANTS, INDUSTRIES, GROUNDWATER, ENVIRONMENTAL EFFECTS,
1655 DISPOSAL , CONTAMINANTS, REFINERIES, WASTEWATERS, SOLID WASTES, INLAND, *WASTE DISPOSAL PRACTICES, *LANDFILLS,
1663 DISPOSAL , WASTEWATER TREATMENT, REFINERIES, *BIOLOGICAL TREATMENT, *UNDERGROUND WASTE INJECTION,
2064 DISPOSAL , BIODEGRADATION, SLUDGE, SOIL, WASTE OIL, REFINERIES,
1636 DISTILLATION, POLLUTION CONTROL, OIL-WATER SEPARATION, OIL DISCHARGES, USSR,
1646 DISTRIBUTION, CANADA, ATLANTIC OCEAN, TAR, OCEANS, SARGASSO SEA,
1672 DISTRIBUTION, CHRONIC EFFECTS, AUSTRALIA, MONITORING, HYDROCARBONS, SOURCES, *MYTILUS EDULIS, *INDICATOR SPECIES,
1700 DISTRIBUTION, BERING SEA, ALASKA/GULF OF, SAMPLING, TAR, *PLASTICS,
2001 DISTRIBUTION, COASTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, ENVIRONMENTAL EFFECTS,
2083 DISTRIBUTION, *OIL PARTICLES, SEAWATER,
2094 DISTRIBUTION, BIODEGRADATION, BALTIC SEA, OIL SPILLS, MODELS, FATE, INTERTIDAL ZONE,
1693 DRILLING , DESIGN-ENGINEERING, BLOWOUT PREVENTION, PATENT,
2035 DRILLING , CONTAMINATION, GROUNDWATER, OIL WELLS, *DRILLING FLUIDS, *WELL COMPLETION,
2056 DRILLING , BIOLOGICAL EFFECTS, *DRILL CUTTINGS, FATE, OCEANS,
1934 ECHINODERMS, DISPERSANTS, TOXICITY, *ESSO COREXIT 9527, *FERTILIZATION,
2076 ECHINODERMS, CRUDE OIL, BIODEGRADATION, TOXICITY, *EKOFISK OIL,
1904 ECONOMIC EFFECTS, BLOWOUTS, STATISTICAL ANALYSIS, ENVIRONMENTAL PROTECTION, NORTH SEA,
1990 ECONOMIC EFFECTS, COST ANALYSIS, API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL, EPA,
1992 ECONOMIC EFFECTS, CANADA, TANKERS, OIL SPILLS, LEGISLATION, ENVIRONMENTAL EFFECTS,
2019 ECONOMIC EFFECTS, COST ANALYSIS, OIL INDUSTRY, REGULATIONS, POLLUTION PREVENTION,
2044 ECONOMIC EFFECTS, OIL INDUSTRY, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, OCS, LOUISIANA,
1646 ECONOMICS, TANKERS, OIL SPILLS, SAFETY, *LIBERIAN REGISTRY,
1604 ECONOMICS, WASTE OIL DISPOSAL, STORAGE, UK,
1661 ECONOMICS, CRUDE OIL, COST ANALYSIS, WASTEWATER TREATMENT, REFINERIES, USSR,
1676 ECONOMICS, WASTE OIL, RECLAMATION, REUSE,
1991 ECONOMICS, CALIFORNIA, OIL SPILLS, INLAND, SPILL CLEANUP, RESTORATION,
2116 ECONOMICS, CANADA, REGULATIONS, WASTEWATERS, REFINERIES, ENVIRONMENTAL PROTECTION, *QUEBEC,
1951 ECOSYSTEMS, BIOLOGICAL EFFECTS, ARCTIC, HYDROCARBONS, MARINE ORGANISMS, SUBARCTIC REGIONS,
1797 EIS, CRUDE OIL, ALASKA, OIL TRANSPORT, PIPELINES, TEXAS, OIL SPILLS,
1798 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, *SALT DOMES, OIL TANKS, *STRATEGIC PETROLEUM RESERVE,
1799 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, *SALT DOMES, *MINES, *STRATEGIC PETROLEUM RESERVE,
1800 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
2024 EIS, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, MEXICO/GULF OF,
2025 EIS, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, MEXICO/GULF OF,

2028 EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS,
2029 EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
2030 EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS,
2031 EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
2032 EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
2033 EIS, ALASKA, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS,
2111 EIS, OIL TRANSPORT, TANKERS, US, REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES,
2112 EIS, OIL TRANSPORT, TANKERS, SEGREGATED BALLAST , REGULATIONS, US, POLLUTION CONTROL, OIL DISCHARGES,
1634 EKOFISK BLOWOUT, CRUDE OIL, OIL SPILLS, FATE,
1635 EKOFISK BLOWOUT, COST ANALYSIS, OFFSHORE DRILLING, OFFSHORE EXPLORATION, NORWAY,
1643 EKOFISK BLOWOUT, ENVIRONMENTAL EFFECTS, PRODUCTION , NORTH SEA,
1647 EKOFISK BLOWOUT, OIL SPILLS, FISH, NORTH SEA,
1654 EKOFISK BLOWOUT, OIL SPILLS, SPILL CLEANUP, POLLUTION CONTROL, NORTH SEA,
1658 EKOFISK BLOWOUT, ENVIRONMENTAL PROTECTION, WILDLIFE, NORTH SEA,
1665 EKOFISK BLOWOUT, NORTH SEA, POLLUTION CONTROL,
2020 EKOFISK BLOWOUT, OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL PROTECTION, SAFETY, REGULATIONS,
2060 EMULSIFICATION, BIODEGRADATION, BACTERIA, HYDROCARBONS, FRESHWATER, *KEROSENE,
1746 EMULSIFIERS, DISPERSANTS, SPILL CLEANUP, SOLUTION, TOXICITY,
1850 EMULSIFIERS, ADSORPTION, WASTEWATER TREATMENT, SLUDGE, FLOTATION, PATENT,
1965 EMULSIFIERS, CRUDE OIL, BIBLIOGRAPHIES, HYDROCARBONS, TOXICITY, MOLLUSKS, SURFACTANTS, *MUSSELS,
1978 EMULSIFIERS, ALGAE, TOXICITY, SURFACTANTS, *SEAWEED, *GROWTH RATES,
1768 EMULSIONS, FILTRATION, EVAPORATION, INCINERATION, *OIL REMOVAL,
1784 EMULSIONS, OIL-WATER SEPARATION, SEAWATER, PETROLEUM PRODUCTS, FLOTATION,
1805 EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOTATION,
1806 EMULSIONS, OIL-WATER SEPARATION, PATENT, *AMINE ADDITION,
1807 EMULSIONS, WASTE OIL TREATMENT, FILTRATION, *ULTRAFILTRATION ,
1808 EMULSIONS, WASTEWATER TREATMENT, INDUSTRIES, FILTRATION, OIL-WATER SEPARATION, *ULTRAFILTRATION ,
1811 EMULSIONS, OIL-WATER SEPARATION, FILTRATION, PATENT, *ULTRAFILTRATION ,
1814 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, WASTE OIL,
1824 EMULSIONS, CRUDE OIL, OIL-WATER SEPARATION, PATENT,
1826 EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT, *CELLULOSE PULP,
1831 EMULSIONS, CRUDE OIL, OIL-WATER SEPARATION, PATENT,
1832 EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, OXIDATION, PATENT,
1852 EMULSIONS, CRUDE OIL, OIL-WATER SEPARATION,
1854 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOTATION, PATENT, *CATIONIC POLYMERS,
1860 EMULSIONS, DESIGN-ENGINEERING, WASTE OIL TREATMENT, REFINERIES,
1864 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOTATION,
1869 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION, PATENT, *ULTRAFILTRATION ,
1871 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1872 EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, FILTRATION, POLAND, *CELLULOSE, *DIATOMACEOUS EARTH,
1888 EMULSIONS, DESIGN-ENGINEERING, POLLUTION PREVENTION, OFFSHORE DRILLING, *DRILLING MUDS,
1965 EMULSIONS, FUEL OIL, MOLLUSKS, UPTAKE, RELEASE, *MYA ARENARIA L.,
2084 EMULSIONS, CRUDE OIL, PHYSICAL EFFECTS, *SUSPENDED SOLIDS, *STABILITY,
1793 ENGLAND, CONTAMINATION, RESTORATION, VEGETATION, MARSHES, WASTEWATERS, REFINERIES, *SALT MARSH,
1794 ENGLAND, BIOLOGICAL EFFECTS, ALGAE, RESTORATION, SHORELINES, OIL SPILLS, MOLLUSKS, *ROCKY SHORES,
2119 ENGLAND, CANADA, LEGISLATION, LAW ENFORCEMENT, SHIPS, OIL SPILLS,
2047 ENVIRONMENTAL DETERIORATION, ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS,
1643 ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, PRODUCTION , NORTH SEA,
1664 ENVIRONMENTAL EFFECTS, BEHAVIOR, OIL SPILLS, FATE, SPILL CLEANUP, MONITORING, *1977 OIL SPILL CONFERENCE,
1676 ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, ALASKA COAST, MONITORING, OFFSHORE DEVELOPMENT, OCS, INFORMATION SYSTEMS, NOAA,
1679 ENVIRONMENTAL EFFECTS, MONITORING, HYDROCARBONS, OIL TRANSPORT, PIPELINES, REFINERIES, PUGET SOUND,
1692 ENVIRONMENTAL EFFECTS, CONTAMINANTS, REMOTE SENSING, MONITORING, OIL SPILLS,
1798 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *SALT DOMES, OIL TANKS, *STRATEGIC PETROLEUM RESERVE,
1799 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *SALT DOMES, *MINES, *STRATEGIC PETROLEUM RESERVE,
1800 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
1818 ENVIRONMENTAL EFFECTS, DISPOSAL , CRUDE OIL, CONTAMINANTS, INDUSTRIES, GROUNDWATER,
1840 ENVIRONMENTAL EFFECTS, WASTEWATERS, OIL DISCHARGES, FUEL OIL, GASOLINE, LUBRICATING OIL, MONITORING, *DISSOLVED ORGANICS,

1906 ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, OIL SPILLS, OCEANS, INLAND, SPILL CLEANUP,
1907 ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, POLLUTION CONTROL,
1910 ENVIRONMENTAL EFFECTS, OIL SPILLS, TOXICITY, MARINE ORGANISMS,
1927 ENVIRONMENTAL EFFECTS, BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ORGANISMS, SANTA BARBARA CHANNEL,
1992 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CANADA, TANKERS, OIL SPILLS, LEGISLATION,
1993 ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, SEDIMENTS, MAGELLAN/STRAIT OF,
1994 ENVIRONMENTAL EFFECTS, TANKERS, OIL SPILLS,
1995 ENVIRONMENTAL EFFECTS, OIL SPILLS, TANKERS, MALAYSIA,
1996 ENVIRONMENTAL EFFECTS, DISPERSANTS, OIL SPILLS, SHORELINES, INTERTIDAL ZONE, MARINE ORGANISMS, TOXICITY,
1997 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OIL SPILLS, US, *WORLD WAR II,
1999 ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, OIL SPILLS, VEGETATION, SOIL, MARSHES,
2001 ENVIRONMENTAL EFFECTS, DISTRIBUTION, COASTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL,
2005 ENVIRONMENTAL EFFECTS, CONTAMINATION, CHRONIC EFFECTS, HYDROCARBONS, MARINE ORGANISMS, OIL SPILLS,
2007 ENVIRONMENTAL EFFECTS, CONTAMINANTS, FUELS, PRODUCTION ,
2009 ENVIRONMENTAL EFFECTS, CONTAMINATION, FISHERIES, *SHELLFISH ,
2010 ENVIRONMENTAL EFFECTS, DISPERSANTS, OIL SLICKS, PHYTOPLANKTON, TOXICITY, *LIGHT REDUCTION, *PHOTOSYNTHESIS,
2013 ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS,
2014 ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS, FISH, PLANKTON ,
2015 ENVIRONMENTAL EFFECTS, BIRDS, ARCTIC, ALASKA, HABITAT,*SHORELINES, OFFSHORE DEVELOPMENT, *SHOREBIRD SPECIES,
2016 ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, SHORELINES, OFFSHORE DEVELOPMENT, OIL SPILLS,
2017 ENVIRONMENTAL EFFECTS, ARCTIC, OIL TRANSPORT, PIPELINES, FRESHWATER, EPA,
2023 ENVIRONMENTAL EFFECTS, OIL INDUSTRY, REFINING, POLLUTION CONTROL, *TECHNOLOGY ASSESSMENT,
2024 ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING, OCS, MEXICO/GULF OF,
2025 ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING, OCS, MEXICO/GULF OF,
2027 ENVIRONMENTAL EFFECTS, BERING SEA, ALASKA/GULF OF, OFFSHORE EXPLORATION, OIL-GAS LEASING, OCS,
2028 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING,
2029 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT,
2030 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING,
2031 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT,
2032 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING, OFFSHORE DEVELOPMENT,
2033 ENVIRONMENTAL EFFECTS, EIS, ALASKA, OIL-GAS LEASING, OCS, SOCIO-ECONOMIC EFFECTS,
2034 ENVIRONMENTAL EFFECTS, CANADA, ARCTIC, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, ICE, OIL INDUSTRY,
2039 ENVIRONMENTAL EFFECTS, OIL SHALE, INDUSTRIES, MONITORING, *R & D NEEDS,
2040 ENVIRONMENTAL EFFECTS, PRODUCTION , FOSSIL FUELS , OIL SHALE, TAR SANDS,
2042 ENVIRONMENTAL EFFECTS, CONTAMINANTS, COASTS, OFFSHORE DRILLING, FISH,
2043 ENVIRONMENTAL EFFECTS, BLM, OFFSHORE DEVELOPMENT, OCS,
2044 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY, OFFSHORE DRILLING, OCS, LOUISIANA,
2045 ENVIRONMENTAL EFFECTS, CRUDE OIL, ALASKA, OFFSHORE DEVELOPMENT, OCS, OIL-GAS LEASING,
2046 ENVIRONMENTAL EFFECTS, DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS, FISHERIES, NEW JERSEY,
2050 ENVIRONMENTAL EFFECTS, OIL INDUSTRY, PETROCHEMICALS, REFINERIES,
2052 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, OCS, ONSHORE IMPACTS, POLLUTION PREVENTION,
2054 ENVIRONMENTAL EFFECTS, ARCTIC, OFFSHORE DEVELOPMENT, ICE, *ICE COVERED WATERS, *RESEARCH TECHNOLOGY,
2055 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, OCS, US, SOCIO-ECONOMIC EFFECTS, STATE GOVERNMENTS,
2090 ENVIRONMENTAL EFFECTS, BEHAVIOR, ARGO MERCHANT SPILL, MONITORING, MOVEMENT, SAMPLING,
2109 ENVIRONMENTAL EFFECTS, COASTS, LEGISLATION, US, OCS, OFFSHORE DEVELOPMENT, REFINERIES,
2129 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION,
2130 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION,
2131 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, POLLUTION CONTROL,
2132 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, EXTRACTION, POLLUTION CONTROL,
2133 ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, ESTUARIES, MARINE ORGANISMS,
2021 ENVIRONMENTAL MANAGEMENT, OCS, OFFSHORE DRILLING, FOSSIL FUELS , REGULATIONS, POLLUTION CONTROL,
2046 ENVIRONMENTAL MANAGEMENT, COASTS, OFFSHORE DEVELOPMENT, GUIDELINES, *CZM,
2053 ENVIRONMENTAL MANAGEMENT, COASTS, OIL INDUSTRY, LOUISIANA, LEGISLATION, US,

1638 ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, CANADA, ARCTIC OCEAN,
1655 ENVIRONMENTAL PROTECTION, OIL SPILLS, OIL TRANSFER, TANKERS, SURVEILLANCE, NORTH SEA,
1658 ENVIRONMENTAL PROTECTION, EKOFISK BLOWOUT, WILDLIFE, NORTH SEA,
1709 ENVIRONMENTAL PROTECTION, DETECTION, CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS, SURFACTANTS,
1795 ENVIRONMENTAL PROTECTION, CRUDE OIL, TANKERS, STORAGE, FEA,
1904 ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS, BLOWOUTS, STATISTICAL ANALYSIS, NORTH SEA,
2020 ENVIRONMENTAL PROTECTION, EKOFISK BLOWOUT, OFFSHORE DEVELOPMENT, NORTH SEA, SAFETY, REGULATIONS,
2036 ENVIRONMENTAL PROTECTION, DEVELOPMENT , CANADA, TAR SANDS, EXTRACTION, *ALBERTA,
2113 ENVIRONMENTAL PROTECTION, REGULATIONS, TANKERS, SEGREGATED BALLAST , USCG,
2117 ENVIRONMENTAL PROTECTION, CANADA, GUIDELINES, REFINERIES, WASTEWATER TREATMENT, *ALBERTA,
2118 ENVIRONMENTAL PROTECTION, ECONOMICS, CANADA, REGULATIONS, WASTEWATERS, REFINERIES, *QUEBEC,
1846 EPA, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, REFINERIES, *ANALYTICAL VARIABILITY,
1886 EPA, CONTINGENCY PLANNING, SPILL CLEANUP, USCG,
1990 EPA, ECONOMIC EFFECTS, COST ANALYSIS, API, REGULATIONS, OIL INDUSTRY, POLLUTION CONTROL,
2017 EPA, ENVIRONMENTAL EFFECTS, ARCTIC, OIL TRANSPORT, PIPELINES, FRESHWATER,
2123 EPA, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, IMCO, SWEDEN, *BALTIC CONVENTION,
1699 ESTUARIES, DETECTION, CARCINOGENS, SAMPLING, PAH, MOLLUSKS, OREGON, *BIVALVES,
1900 ESTUARIES, POLLUTION CONTROL, *CONFERENCE,
1915 ESTUARIES, CRUSTACEANS, BIOLOGICAL EFFECTS, AROMATIC HYDROCARBONS , *COPEPOD,
1948 ESTUARIES, CRUDE OIL, TOXICITY, PHYTOPLANKTON, *KUWAIT CRUDE,
1954 ESTUARIES, CRUDE OIL, CONTAMINATION, FISH, *FIN ROT, *MULLET,
2049 ESTUARIES, DEVELOPMENT , CONTAMINATION, COASTS, OIL INDUSTRY,
2061 ESTUARIES, BIODEGRADATION, BACTERIA, *ENRICHMENT TECHNIQUES,
2091 ESTUARIES, HYDROCARBONS, FUEL OIL, SEDIMENTS, MARINE ORGANISMS, VIRGINIA,
2133 ESTUARIES, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, MARINE ORGANISMS,
1663 EUROPE, OIL SPILLS, OIL TRANSPORT, PIPELINES, SPILL CLEANUP, *CROSS COUNTRY PIPELINES ,
1887 EUROPE, CONTINGENCY PLANNING, SPILL CLEANUP, PERSONNEL TRAINING, UK, US,
1768 EVAPORATION, EMULSIONS, FILTRATION, INCINERATION, *OIL REMOVAL,
1803 EVAPORATION, WASTEWATER TREATMENT, REFINERIES, INCINERATION, PATENT, *THERMAL OXIDATION ,
2085 EVAPORATION, HYDROCARBONS, OIL SPILLS, FATE, SOLUTION, WEATHERING,
2087 EVAPORATION, DELAWARE BAY, OIL SPILLS, MODELS, WEATHERING, OIL TRANSFER,
2105 EVAPORATION, DISPERSIONS, CONTAMINATION, FATE, SEAWATER, SPREADING, OXIDATION, SOLUTION,
1998 EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SHIPS, PRODUCTION , SEABIRDS, MARINE ORGANISMS, FISHERIES, SPILL CLEANUP,
1816 EXTRACTION, CONTAMINANTS, WASTEWATER TREATMENT, REFINERIES, SOLVENTS,
2011 EXTRACTION, CARCINOGENS, OIL SHALE, HEALTH HAZARDS, *BENZO(A)PYRENE,
2036 EXTRACTION, ENVIRONMENTAL PROTECTION, DEVELOPMENT , CANADA, TAR SANDS, *ALBERTA,
2129 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE,
2130 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE,
2131 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, POLLUTION CONTROL,
2132 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, OIL SHALE, POLLUTION CONTROL,
1634 FATE, EKOFISK BLOWOUT, CRUDE OIL, OIL SPILLS,
1656 FATE, COASTS, URQUIOLA SPILL, POLLUTION CONTROL, SPILL CLEANUP, SPAIN,
1664 FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, OIL SPILLS, SPILL CLEANUP, MONITORING, *1977 OIL SPILL CONFERENCE,
1673 FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA, MONITORING, MOVEMENT, MICROORGANISMS, *PERMAFROST TERRAIN,
2056 FATE, DRILLING , BIOLOGICAL EFFECTS, *DRILL CUTTINGS, OCEANS,
2085 FATE, EVAPORATION, HYDROCARBONS, OIL SPILLS, SOLUTION, WEATHERING,
2088 FATE, MODELS, OIL SPILLS, OXIDATION, *N-HEXADECANE, *PHOTOOXIDATION ,
2092 FATE, BIODEGRADATION, PETROLEUM PRODUCTS, SURFACTANTS, SEAWATER, SEDIMENTS, *SELF-PURIFICATION, *SEA OF AZOV,
2094 FATE, DISTRIBUTION, BIODEGRADATION, BALTIC SEA, OIL SPILLS, MODELS, INTERTIDAL ZONE,
2096 FATE, ALASKA, OIL SPILLS, ICE, *OIL-UNDER-ICE , *IMPULSE RADAR SYSTEM,
2097 FATE, BIODEGRADATION, HYDROCARBONS, SEAWATER, ECOSYSTEM, SEDIMENTATION, *NAPHTHALENES,
2099 FATE, DISPERSANTS, BIOLOGICAL EFFECTS, OIL SPILLS,
2101 FATE, HYDROCARBONS, SEAWATER, MARINE ORGANISMS, *MOLECULAR INTERACTIONS,
2105 FATE, EVAPORATION, DISPERSIONS, CONTAMINATION, SEAWATER, SPREADING, OXIDATION, SOLUTION,
1795 FEA, ENVIRONMENTAL PROTECTION, CRUDE OIL, TANKERS, STORAGE,
1768 FILTRATION, EVAPORATION, EMULSIONS, INCINERATION, *OIL REMOVAL,
1807 FILTRATION, EMULSIONS, WASTE OIL TREATMENT, *ULTRAFILTRATION ,
1808 FILTRATION, EMULSIONS, WASTEWATER TREATMENT, INDUSTRIES, OIL-WATER SEPARATION, *ULTRAFILTRATION ,
1810 FILTRATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
1811 FILTRATION, EMULSIONS, OIL-WATER SEPARATION, PATENT, *ULTRAFILTRATION ,

1813 FILTRATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES, PENNSYLVANIA, *SAND FILTERS,
1822 FILTRATION, WASTEWATER TREATMENT, REFINERIES,
1834 FILTRATION, CANADA, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES, *DUAL-MEDIA FILTERS,
1844 FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, REFINERIES, SOLID WASTES, OHIO, *UPFLOW SAND FILTERS,
1857 FILTRATION, REFINERIES, WASTEWATER TREATMENT, WATER QUALITY, *ONTARIO,
1869 FILTRATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT, *ULTRAFILTRATION ,
1872 FILTRATION, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, POLAND, *CELLULOSE, *DIATOMACEOUS EARTH,
1873 FILTRATION, COALESCENCE, WASTE OIL, LUBRICATING OIL, RECYCLING,
1877 FILTRATION, WASTE OIL, LUBRICATING OIL, RECLAMATION, OIL-WATER SEPARATION, FUELS, *USCG POWER PLANTS,
1647 FISH, EKOFISK BLOWOUT, OIL SPILLS, NORTH SEA,
1666 FISH, DISPERSANTS, TOXICITY, TROPICAL REGIONS, JAPAN, *WARREN SPRINGS LABORATORY, *HONG KONG,
1712 FISH, CONTAMINATION, CHEMICAL ANALYSIS, SOURCES, PETROLEUM PRODUCTS, GREAT LAKES ,
1922 FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, INVERTEBRATES, FOOD WEB,
1931 FISH, CRUDE OIL, BIOLOGICAL EFFECTS, *FIN ROT, *MUGIL CEPHALUS,
1932 FISH, DISPERSANTS, BIOLOGICAL EFFECTS, SURFACTANTS, TOXICITY,
1933 FISH, HYDROCARBONS, UPTAKE, RELEASE, *COHO AND CHINOOK SALMON, *CHLORINATED BIPHENYLS, *ENZYME ACTIVITY,
1936 FISH, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, *TISSUES, *MORPHOLOGICAL CHANGES,
1938 FISH, CRUDE OIL, CHRONIC EFFECTS, TOXICITY, *TROUT REPRODUCTION,
1942 FISH, PETROLEUM PRODUCTS, TOXICITY, METABOLISM, *SPICARA SMARIS, *SOLEA LASCARIS NASUTA,
1943 FISH, PETROLEUM PRODUCTS, TOXICITY, *HEMATOLOGICAL CHANGES,
1949 FISH, CHRONIC EFFECTS, TOXICITY, FRESHWATER, LUBRICATING OIL, *SYNTHETIC OIL,
1952 FISH, BIOLOGICAL EFFECTS, OIL SPILLS, FUEL OIL, INVERTEBRATES, STREAMS, VIRGINIA,
1954 FISH, ESTUARIES, CRUDE OIL, CONTAMINATION, *FIN ROT, *MULLET,
1963 FISH, CRUDE OIL, FUEL OIL, TOXICITY, HYDROCARBONS, METABOLISM,*RESPIRATION, *ONCORHYNCHUS GORBUSCHA,
1972 FISH, TOXICITY, HYDROCARBONS, *BENZENE, *REPRODUCTION, *CLUPEA HARENGUS PALLASI,
1983 FISH, DISPERSANTS, BIOLOGICAL EFFECTS, SPILL CLEANUP, *EMBRYO DEVELOPMENT,
2014 FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS, PLANKTON ,
2042 FISH, ENVIRONMENTAL EFFECTS, CONTAMINANTS, COASTS, OFFSHORE DRILLING,
2093 FISH, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BIODEGRADATION, AROMATIC HYDROCARBONS , OIL SPILLS, WEATHERING, NORWAY, *T/T "DRUPA" SPILL,
2127 FISH, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, FRESHWATER,
1998 FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SHIPS, PRODUCTION , SEABIRDS, MARINE ORGANISMS, SPILL CLEANUP,
2002 FISHERIES, BIRDS, OIL SPILLS, REFINERIES, OIL TRANSPORT, OFFSHORE PRODUCTION, POLLUTION CONTROL, TOXICITY, NORTH SEA,
2003 FISHERIES, CRUDE OIL, AROMATIC HYDROCARBONS , OFFSHORE DEVELOPMENT, NORTH SEA,
2009 FISHERIES, ENVIRONMENTAL EFFECTS, CONTAMINATION, *SHELLFISH ,
2012 FISHERIES, OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, SCOTLAND,
2048 FISHERIES, ENVIRONMENTAL EFFECTS, DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS, NEW JERSEY,
1780 FLOCCULATION, SPILL RECOVERY, SEAWATER, RIVERS, SOLVENTS, COAGULATION, PATENT,
1823 FLOCCULATION, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, OIL-WATER SEPARATION, PATENT,
1848 FLOCCULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
1849 FLOCCULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
1858 FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, OIL-WATER SEPARATION, PATENT, *SOLVENT RECOVERY ,
1859 FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, OIL-WATER SEPARATION, PATENT, *SOLVENT RECOVERY ,
1867 FLOCCULATION, WASTEWATER TREATMENT, SURFACTANTS, OIL-WATER SEPARATION, PATENT,
1870 FLOCCULATION, PETROLEUM PRODUCTS, WASTEWATER TREATMENT,
1784 FLOTATION, EMULSIONS, OIL-WATER SEPARATION, SEAWATER, PETROLEUM PRODUCTS,
1805 FLOTATION, EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1815 FLOTATION, DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, SHIPS, PATENT,
1835 FLOTATION, WASTEWATER TREATMENT, PATENT, *TETRAETHYLEAD REMOVAL,
1845 FLOTATION, DESIGN-ENGINEERING, OIL-WATER SEPARATION, SKIMMERS, PATENT,
1850 FLOTATION, EMULSIFIERS, ADSORPTION, WASTEWATER TREATMENT, SLUDGE, PATENT,
1854 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT, *CATIONIC POLYMERS,
1864 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1922 FOOD WEB, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL, INVERTEBRATES,
1976 FOOD WEB, HYDROCARBONS, UPTAKE, RELEASE, OCEANS, *FOOD CHAIN TRANSFER,
1706 FOSSIL FUELS , ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES,
2021 FOSSIL FUELS , ENVIRONMENTAL MANAGEMENT, OCS, OFFSHORE DRILLING, REGULATIONS,

POLLUTION CONTROL,
2040 FOSSIL FUELS , ENVIRONMENTAL EFFECTS, PRODUCTION , OIL SHALE, TAR SANDS,
1739 FRESHWATER, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, OCEANS,
1759 FRESHWATER, CONTAMINATION, ADSORPTION, FUEL OIL, *ACTIVATED CARBON, *WATER SUPPLY,
1791 FRESHWATER, DISPOSAL , DISPERSANTS, COASTS, BEACHES, ABSORPTION, SPILL CLEANUP, MARSHES, SEAWATER,
1919 FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, BACTERIA, FUNGI, ICE, *OIL-UNDER-ICE ,
1946 FRESHWATER, REFINERIES, TOXICITY, WASTEWATERS, MONITORING, INVERTEBRATES, *DAPHNIA PULEX, *BIOASSAY,
1949 FRESHWATER, FISH, CHRONIC EFFECTS, TOXICITY, LUBRICATING OIL, *SYNTHETIC OIL,
1955 FRESHWATER, CRUDE OIL, BIODEGRADATION, BACTERIA, ALGAE, PETROLEUM PRODUCTS, GASOLINE, TOXICITY, *PHOTOSYNTHESIS,
1980 FRESHWATER, CRUDE OIL, ARCTIC, TOXICITY, PHYTOPLANKTON, *PRIMARY PRODUCTION,
2017 FRESHWATER, EPA, ENVIRONMENTAL EFFECTS, ARCTIC, OIL TRANSPORT, PIPELINES,
2060 FRESHWATER, EMULSIFICATION, BIODEGRADATION, BACTERIA, HYDROCARBONS, *KEROSENE,
2069 FRESHWATER, BIODEGRADATION, BACTERIA, HYDROCARBONS, FUNGI, SEDIMENTS,
2127 FRESHWATER, FISH, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES,
1705 FUEL OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SEAWATER, *WATER-SOLUBLE FRACTION,
1724 FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, *OIL-GREASE DETERMINATION,
1727 FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, PETROLEUM PRODUCTS, SPECTROSCOPY,
1759 FUEL OIL, FRESHWATER, CONTAMINATION, ADSORPTION, *ACTIVATED CARBON, *WATER SUPPLY,
1777 FUEL OIL, ADSORPTION, SPILL RECOVERY, PATENT, *SAWDUST,
1787 FUEL OIL, ADSORPTION, SPILL CLEANUP, GASOLINE, PATENT,
1840 FUEL OIL, ENVIRONMENTAL EFFECTS, WASTEWATERS, OIL DISCHARGES, GASOLINE, LUBRICATING OIL, MONITORING, *DISSOLVED ORGANICS,
1911 FUEL OIL, BIRDS, BIOLOGICAL EFFECTS, *HATCHABILITY, *MALLARD DUCK EGGS,
1914 FUEL OIL, CRUDE OIL, ALGAE, TOXICITY,
1921 FUEL OIL, CRUDE OIL, TOXICITY, POLYCHAETES, *REPRODUCTION,
1923 FUEL OIL, CRUDE OIL, CANADA, BIOLOGICAL EFFECTS, MICROORGANISMS, *GEORGIA STRAIT, *HETEROTROPHIC POTENTIAL, *PRODUCTIVITY,
1925 FUEL OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, MARSHES, *SALTMARSH,
1944 FUEL OIL, CRUSTACEANS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MASSACHUSETTS, *UCA PUGNAX,
1945 FUEL OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, METABOLISM, *TEMPERATURE, *SALINITY, *LIMULUS POLYPHEMUS,
1952 FUEL OIL, FISH, BIOLOGICAL EFFECTS, OIL SPILLS, INVERTEBRATES, STREAMS, VIRGINIA,
1962 FUEL OIL, CRUDE OIL, TOXICITY, UPTAKE, RELEASE, MARINE ORGANISMS,
1963 FUEL OIL, FISH, CRUDE OIL, TOXICITY, HYDROCARBONS, METABOLISM,*RESPIRATION, *ONCORHYNCHUS GORBUSCHA,
1968 FUEL OIL, EMULSIONS, MOLLUSKS, UPTAKE, RELEASE, *MYA ARENARIA L.,
1973 FUEL OIL, BIRDS, BIOLOGICAL EFFECTS, *HATCHABILITY, *COMMON EIDER EGGS,
1974 FUEL OIL, CRUSTACEANS, HYDROCARBONS, UPTAKE, METABOLISM, *NAPHTHALENES, *HATCHING, *LARVAL GROWTH, *GRASS SHRIMP,
2080 FUEL OIL, CASPIAN SEA, BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, OXIDATION,
2089 FUEL OIL, TOXICITY, YEASTS, OXIDATION, *UV IRRADIATION,
2091 FUEL OIL, ESTUARIES, HYDROCARBONS, SEDIMENTS, MARINE ORGANISMS, VIRGINIA,
2107 FUEL OIL, DECOMPOSITION, BIODEGRADATION, MICROORGANISMS, *PHYSICOCHEMICAL DEGRADATION,
1847 FUELS, WASTEWATER DISPOSAL, WASTE OIL, RECLAMATION, *LAND DISPOSAL, *SPRAY IRRIGATION,
1875 FUELS, CRUDE OIL, SPILL RECOVERY, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1877 FUELS, FILTRATION, WASTE OIL, LUBRICATING OIL, RECLAMATION, OIL-WATER SEPARATION, *USCG POWER PLANTS,
1969 FUELS, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, PETROLEUM PRODUCTS, *GROWTH, *REPRODUCTION, *FUCUS EDENTATUS DE LA PYL,
2007 FUELS, ENVIRONMENTAL EFFECTS, CONTAMINANTS, PRODUCTION ,
1919 FUNGI, FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, BACTERIA, ICE, *OIL-UNDER-ICE ,
2069 FUNGI, FRESHWATER, BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS,
2075 FUNGI, BIODEGRADATION, BACTERIA, WASTE OIL, SOIL, MONITORING, *ARID SITE,
1787 GASOLINE, FUEL OIL, ADSORPTION, SPILL CLEANUP, PATENT,
1827 GASOLINE, DESIGN-ENGINEERING, OIL-WATER SEPARATION, SLUDGE, WASTEWATERS, PATENT,
1840 GASOLINE, FUEL OIL, ENVIRONMENTAL EFFECTS, WASTEWATERS, OIL DISCHARGES, LUBRICATING OIL, MONITORING, *DISSOLVED ORGANICS,
1955 GASOLINE, FRESHWATER, CRUDE OIL, BIODEGRADATION, BACTERIA, ALGAE, PETROLEUM PRODUCTS, TOXICITY, *PHOTOSYNTHESIS,
2071 GASOLINE, BIODEGRADATION, ALASKA, HYDROCARBONS, MICROORGANISMS, LAKES, SEDIMENTS,
2072 GASOLINE, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, MICROORGANISMS, LAKES,
1837 GERMANY, EAST, REFINERIES, OIL INDUSTRY, PETROCHEMICALS, WASTEWATER TREATMENT,
2120 GOVERNMENT AGENCIES, REGULATIONS, TANKERS, PORTS, USCG, SAFETY, LAW ENFORCEMENT,
1712 GREAT LAKES, PETROLEUM PRODUCTS, FISH, CONTAMINATION, CHEMICAL ANALYSIS, SOURCES,
1891 GREENLAND, ARCTIC, OFFSHORE DRILLING, SAFETY, POLLUTION PREVENTION, *ICEBERGS,
1729 GROUNDWATER, CONTAMINATION, SOURCE IDENTIFICATION, OIL WELLS, PRODUCTION , WASTEWATERS, *BRINE DISPOSAL,
1802 GROUNDWATER, ADSORPTION, OIL TRANSPORT, *LIME, *CLAY, *SOIL COMPONENTS,

1818 GROUNDWATER, ENVIRONMENTAL EFFECTS, DISPOSAL , CRUDE OIL, CONTAMINANTS, INDUSTRIES,
2035 GROUNDWATER, DRILLING , CONTAMINATION, OIL WELLS, *DRILLING FLUIDS, *WELL COMPLETION,
2046 GUIDELINES, ENVIRONMENTAL MANAGEMENT, COASTS, OFFSHORE DEVELOPMENT, *CZM,
2117 GUIDELINES, ENVIRONMENTAL PROTECTION, CANADA, REFINERIES, WASTEWATER TREATMENT, *ALBERTA,
2122 GUIDELINES, CONTINGENCY PLANNING, MANUALS, POLLUTION PREVENTION, TANKERS,
2015 HABITAT, ENVIRONMENTAL EFFECTS, BIRDS, ARCTIC, ALASKA, SHORELINES, OFFSHORE DEVELOPMENT, *SHOREBIRD SPECIES,
1732 HARBORS, BOOMS, SPILL CONTAINMENT, INLAND, *PRODUCT INFORMATION,
2008 HEALTH HAZARDS, CONTAMINATION, BIOLOGICAL EFFECTS, HYDROCARBONS, OCEANS, POLLUTION CONTROL,
2011 HEALTH HAZARDS, EXTRACTION, CARCINOGENS, OIL SHALE, *BENZO(A)PYRENE,
1671 HYDROCARBONS, MONITORING, SOURCES, PLATFORMS, MEXICO/GULF OF, *GAS VENTING, *BRINE DISCHARGE,
1672 HYDROCARBONS, DISTRIBUTION, CHRONIC EFFECTS, AUSTRALIA, MONITORING, SOURCES, *MYTILUS EDULIS, *INDICATOR SPECIES,
1678 HYDROCARBONS, MONITORING, SEDIMENTS, SOURCES, MEXICO/GULF OF, *CONTINENTAL SHELF,
1679 HYDROCARBONS, ENVIRONMENTAL EFFECTS, MONITORING, OIL TRANSPORT, PIPELINES, REFINERIES, PUGET SOUND,
1698 HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, SEAWATER, OIL-GAS LEASING, MEXICO/GULF OF, *SEASONAL VARIATIONS, *MAFLA LEASE AREA,
1705 HYDROCARBONS, FUEL OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SEAWATER, *WATER-SOLUBLE FRACTION,
1708 HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CANADA, ATLANTIC COAST, SPECTROSCOPY,
1709 HYDROCARBONS, ENVIRONMENTAL PROTECTION, DETECTION, CONTAMINANTS, CHEMICAL ANALYSIS, SURFACTANTS,
1710 HYDROCARBONS, CRUSTACEANS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, ZOOPLANKTON, SEDIMENTS,
1711 HYDROCARBONS, CHROMATOGRAPHY, BEACHES, ANALYTICAL TECHNIQUES, ABSORPTION, SEAWATER, SPECTROSCOPY,
1713 HYDROCARBONS, ANALYTICAL TECHNIQUES, SAMPLING, SEDIMENTS, INTERTIDAL ZONE, WASHINGTON,
1714 HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BASELINE STUDIES, SPECTROSCOPY, MARINE ORGANISMS,
1715 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, MARINE ORGANISMS, SPECTROSCOPY, SPECTROMETRY,
1717 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , MONITORING, SEDIMENTS, *GLASS CAPILLARY COLUMNS,
1725 HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, SPECTROSCOPY, *INTERCALIBRATION,
1726 HYDROCARBONS, CHEMICAL ANALYSIS, ADSORPTION, PETROLEUM PRODUCTS, SEAWATER, SURFACTANTS, *ELECTROANALYSIS ,
1730 HYDROCARBONS, SOURCE IDENTIFICATION, SEDIMENTS, LAKES,
1617 HYDROCARBONS, WASTEWATER TREATMENT, REFINERIES, PETROCHEMICALS, *SOLVENT EXTRACTION ,
1912 HYDROCARBONS, ANNELIDS, SEDIMENT, UPTAKE, RELEASE, *PHASCOLOSOMA AGASSIZII, *NAPHTHALENES,
1913 HYDROCARBONS, BEHAVIOR, ANALYTICAL TECHNIQUES, TOXICITY, MARINE ORGANISMS, METABOLISM, *SUBLETHAL LEVELS,
1924 HYDROCARBONS, CRUDE OIL, BIOLOGICAL EFFECTS, BEAUFORT SEA, UPTAKE, MARINE MAMMALS, *RINGED SEAL,
1925 HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, MARSHES, *SALTMARSH,
1933 HYDROCARBONS, FISH, UPTAKE, RELEASE, *COHO AND CHINOOK SALMON, *CHLORINATED BIPHENYLS, *ENZYME ACTIVITY,
1935 HYDROCARBONS, CRUSTACEANS, PLANKTON , UPTAKE, RELEASE, *14C-1-NAPHTHALENE, *COPEPODS,
1936 HYDROCARBONS, FISH, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, *TISSUES, *MORPHOLOGICAL CHANGES,
1947 HYDROCARBONS, UPTAKE, STORAGE, RELEASE, MARINE ORGANISMS,
1951 HYDROCARBONS, ECOSYSTEMS, BIOLOGICAL EFFECTS, ARCTIC, MARINE ORGANISMS, SUBARCTIC REGIONS,
1956 HYDROCARBONS, BIOLOGICAL EFFECTS, PHYTOPLANKTON, METABOLISM, *PLANT GROWTH, *PHOTOSYNTHESIS,
1959 HYDROCARBONS, DETECTION, CANADA, METABOLISM, MONITORING, MARINE ORGANISMS, *ENZYME ACTIVITY,
1963 HYDROCARBONS, FUEL OIL, FISH, CRUDE OIL, TOXICITY, METABOLISM,*RESPIRATION, *ONCORHYNCHUS GORBUSCHA,
1965 HYDROCARBONS, EMULSIFIERS, CRUDE OIL, BIBLIOGRAPHIES, TOXICITY, MOLLUSKS, SURFACTANTS, *MUSSELS,
1967 HYDROCARBONS, CONTAMINATION, ATLANTIC COAST, OIL DISCHARGES, PHYTOPLANKTON, OCS,
1972 HYDROCARBONS, FISH, TOXICITY, *BENZENE, *REPRODUCTION, *CLUPEA HARENGUS PALLASI,
1974 HYDROCARBONS, FUEL OIL, CRUSTACEANS, UPTAKE, METABOLISM, *NAPHTHALENES, *HATCHING, *LARVAL GROWTH, *GRASS SHRIMP,
1976 HYDROCARBONS, FOOD WEB, UPTAKE, RELEASE, OCEANS, *FOOD CHAIN TRANSFER,
2005 HYDROCARBONS, ENVIRONMENTAL EFFECTS, CONTAMINATION, CHRONIC EFFECTS, MARINE ORGANISMS, OIL SPILLS,

2008 HYDROCARBONS, HEALTH HAZARDS, CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, POLLUTION CONTROL,
2038 HYDROCARBONS, CHEMICAL ANALYSIS, BASELINE STUDIES, ATLANTIC COAST, OCS, OFFSHORE DEVELOPMENT,
2060 HYDROCARBONS, FRESHWATER, EMULSIFICATION, BIODEGRADATION, BACTERIA, *KEROSENE,
2062 HYDROCARBONS, BIODEGRADATION, BEACHES, BACTERIA, SEDIMENT, MAGELLAN/STRAIT OF, METULA SPILL,
2063 HYDROCARBONS, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS , YEASTS, OIL SLICKS, *CHLORINATED HYDROCARBONS ,
2065 HYDROCARBONS, BIODEGRADATION, BACTERIA, OIL SHALE,
2066 HYDROCARBONS, BIODEGRADATION, BACTERIA, *TAXONOMY,
2069 HYDROCARBONS, FUNGI, FRESHWATER, BIODEGRADATION, BACTERIA, SEDIMENTS,
2071 HYDROCARBONS, GASOLINE, BIODEGRADATION, ALASKA, MICROORGANISMS, LAKES, SEDIMENTS,
2076 HYDROCARBONS, BIODEGRADATION, ARCTIC, METABOLISM, MARINE ORGANISMS, SUBARCTIC REGIONS, TOXICITY,
2077 HYDROCARBONS, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, ICE, SEDIMENTS, SEAWATER,
2081 HYDROCARBONS, BIODEGRADATION, BACTERIA, LAKES, WATER QUALITY, WISCONSIN, *NUTRIENT LIMITATION,
2082 HYDROCARBONS, CRUDE OIL, CANADA, BIODEGRADATION, BACTERIA, SOIL, *NUTRIENT ADDITION,
2085 HYDROCARBONS, FATE, EVAPORATION, OIL SPILLS, SOLUTION, WEATHERING,
2091 HYDROCARBONS, FUEL OIL, ESTUARIES, SEDIMENTS, MARINE ORGANISMS, VIRGINIA,
2097 HYDROCARBONS, FATE, BIODEGRADATION, SEAWATER, ECOSYSTEM, SEDIMENTATION, *NAPHTHALENES,
2100 HYDROCARBONS, CRUDE OIL, ADSORPTION, SOIL, *DESORPTION, *ORGANIC MATTER CONTENT,
2101 HYDROCARBONS, FATE, SEAWATER, MARINE ORGANISMS, *MOLECULAR INTERACTIONS,
2102 HYDROCARBONS, ALASKA, UPTAKE, RELEASE, SEDIMENTS, OIL SLICKS, INTERTIDAL ZONE,
1919 ICE, FUNGI, FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, BACTERIA, *OIL-UNDER-ICE ,
2034 ICE, ENVIRONMENTAL EFFECTS, CANADA, ARCTIC, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, OIL INDUSTRY,
2051 ICE, OFFSHORE DEVELOPMENT, OCS, SAFETY, LABRADOR SEA, *MINING TECHNOLOGY,
2054 ICE, ENVIRONMENTAL EFFECTS, ARCTIC, OFFSHORE DEVELOPMENT, *ICE COVERED WATERS, *RESEARCH TECHNOLOGY,
2077 ICE, HYDROCARBONS, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, SEDIMENTS, SEAWATER,
2086 ICE, BEAUFORT SEA, OIL SPILLS, SPREADING, *UNDER-ICE SPILL,
2096 ICE, FATE, ALASKA, OIL SPILLS, *OIL-UNDER-ICE , *IMPULSE RADAR SYSTEM,
2123 IMCO, EPA, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, SWEDEN, *BALTIC CONVENTION,
2126 IMCO, INTERNATIONAL CONVENTIONS, OIL DISCHARGES, TANKERS, LAW ENFORCEMENT,
1766 INCINERATION, FILTRATION, EVAPORATION, EMULSIONS, *OIL REMOVAL,
1776 INCINERATION, ABSORPTION, SPILL RECOVERY, PATENT, *ABSORBENT FIBERS,
1790 INCINERATION, ABSORPTION, SPILL CLEANUP, *GELLING AGENTS,
1803 INCINERATION, EVAPORATION, WASTEWATER TREATMENT, REFINERIES, PATENT, *THERMAL OXIDATION ,
1812 INCINERATION, WASTEWATER DISPOSAL, SLUDGE, REFINERIES, *FLUID BEDS,
1878 INDIA, INDUSTRIES, REFINERIES, WASTEWATERS, RECLAMATION, REUSE,
1806 INDUSTRIES, FILTRATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *ULTRAFILTRATION ,
1818 INDUSTRIES, GROUNDWATER, ENVIRONMENTAL EFFECTS, DISPOSAL , CRUDE OIL, CONTAMINANTS,
1830 INDUSTRIES, CANADA, WASTEWATER TREATMENT, OIL-WATER SEPARATION, RECLAMATION, REUSE,
1878 INDUSTRIES, INDIA, REFINERIES, WASTEWATERS, RECLAMATION, REUSE,
2039 INDUSTRIES, ENVIRONMENTAL EFFECTS, OIL SHALE, MONITORING, *R & D NEEDS,
1649 INFORMATION SYSTEMS, STATISTICS, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, *DATA BANK, UK,
1676 INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, ALASKA COAST, MONITORING, OFFSHORE DEVELOPMENT, OCS, NOAA.
1732 INLAND, HARBORS, BOOMS, SPILL CONTAINMENT, *PRODUCT INFORMATION,
1855 INLAND, DISPOSAL , CONTAMINANTS, REFINERIES, WASTEWATERS, SOLID WASTES, *WASTE DISPOSAL PRACTICES, *LANDFILLS,
1906 INLAND, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, OIL SPILLS, OCEANS, SPILL CLEANUP,
1991 INLAND, ECONOMICS, CALIFORNIA, OIL SPILLS, SPILL CLEANUP, RESTORATION,
1731 INTERNATIONAL AGREEMENTS, SOURCE IDENTIFICATION, OIL DISCHARGES, NATURAL SEEPAGE, OIL SPILLS, OFFSHORE DEVELOPMENT, TANKERS,
2115 INTERNATIONAL AGREEMENTS, INTERNATIONAL CONVENTIONS, LEGISLATION, POLLUTION CONTROL, OCEANS, UK, US,
2124 INTERNATIONAL AGREEMENTS, LIABILITY, OFFSHORE DRILLING, OIL TRANSFER, STORAGE, NORTH SEA,
1902 INTERNATIONAL CONVENTIONS, OIL SPILLS, TANKERS, OIL DISCHARGES, SAFETY, POLLUTION CONTROL, LIABILITY,
2115 INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, LEGISLATION, POLLUTION CONTROL, OCEANS, UK, US,
2116 INTERNATIONAL CONVENTIONS, LEGISLATION, POLLUTION CONTROL,
2123 INTERNATIONAL CONVENTIONS, IMCO, EPA, POLLUTION PREVENTION, SWEDEN, *BALTIC CONVENTION,
2125 INTERNATIONAL CONVENTIONS, BIOLOGICAL EFFECTS, UN, POLLUTION CONTROL, MONITORING, MEDITERRANEAN SEA,
2126 INTERNATIONAL CONVENTIONS, IMCO, OIL DISCHARGES. TANKERS, LAW ENFORCEMENT,
1713 INTERTIDAL ZONE, HYDROCARBONS, ANALYTICAL TECHNIQUES, SAMPLING, SEDIMENTS, WASHINGTON,
1956 INTERTIDAL ZONE, BIOLOGICAL EFFECTS, BALTIC SEA, SPILL CLEANUP,

1957 INTERTIDAL ZONE, BIOMASS, BIOLOGICAL EFFECTS, BACTERIA, SEDIMENTS, MICROORGANISMS,
1971 INTERTIDAL ZONE, BIOLOGICAL EFFECTS, METULA SPILL, MARINE ORGANISMS, MAGELLAN/STRAIT OF,
1977 INTERTIDAL ZONE, CHEDABUCTO BAY, CANADA, OIL SPILLS, TOXICITY, MARINE ORGANISMS, *MORTALITIES,
1996 INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, DISPERSANTS, OIL SPILLS, SHORELINES, MARINE ORGANISMS, TOXICITY,
2094 INTERTIDAL ZONE, FATE, DISTRIBUTION, BIODEGRADATION, BALTIC SEA, OIL SPILLS, MODELS,
2102 INTERTIDAL ZONE, HYDROCARBONS, ALASKA, UPTAKE, RELEASE, SEDIMENTS, OIL SLICKS,
1922 INVERTEBRATES, FOOD WEB, FISH, BIOLOGICAL EFFECTS, ARGO MERCHANT SPILL,
1946 INVERTEBRATES, FRESHWATER, REFINERIES, TOXICITY, WASTEWATERS, MONITORING, *DAPHNIA PULEX, *BIOASSAY,
1952 INVERTEBRATES, FUEL OIL, FISH, BIOLOGICAL EFFECTS, OIL SPILLS, STREAMS, VIRGINIA,
1950 ISRAEL, CORAL REEFS, CONTAMINATION, BIOLOGICAL EFFECTS, RED SEA, *SUCCESSION, *RECOLONIZATION,
1666 JAPAN, FISH, DISPERSANTS, TOXICITY, TROPICAL REGIONS, *WARREN SPRINGS LABORATORY, *HONG KONG,
2106 JAPAN, PETROLEUM PRODUCTS, SEDIMENTS, MOVEMENT, *SETO INLAND SEA,
2051 LABRADOR SEA, ICE, OFFSHORE DEVELOPMENT, OCS, SAFETY, *MINING TECHNOLOGY,
1730 LAKES, HYDROCARBONS, SOURCE IDENTIFICATION, SEDIMENTS,
2071 LAKES, HYDROCARBONS, GASOLINE, BIODEGRADATION, ALASKA, MICROORGANISMS, SEDIMENTS,
2072 LAKES, GASOLINE, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, MICROORGANISMS,
2081 LAKES, HYDROCARBONS, BIODEGRADATION, BACTERIA, WATER QUALITY, WISCONSIN, *NUTRIENT LIMITATION,
1908 LAW ENFORCEMENT, LEGISLATION, POLLUTION PREVENTION, OIL SPILLS, USCG,
2119 LAW ENFORCEMENT, ENGLAND, CANADA, LEGISLATION, SHIPS, OIL SPILLS,
2120 LAW ENFORCEMENT, GOVERNMENT AGENCIES, REGULATIONS, TANKERS, PORTS, USCG, SAFETY,
2126 LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, OIL DISCHARGES, TANKERS,
1686 LEAKAGE, DETECTION, MONITORING, PIPELINES,
1766 LEAKAGE, TANKERS, SPILL CLEANUP, PATENT, *OIL SOLIDIFICATION,
1890 LEAKAGE, SHIPS, POLLUTION PREVENTION, *STERNGEAR SEAL SYSTEM,
1894 LEAKAGE, DETECTION, PIPELINES, PATENT,
1895 LEAKAGE, DESIGN-ENGINEERING, PIPELINES, POLLUTION PREVENTION, PATENT,
1899 LEAKAGE, DETECTION, PRODUCTION , POLLUTION PREVENTION, OIL SPILLS, PIPELINES,
1901 LEAKAGE, DETECTION, DESIGN-ENGINEERING, PIPELINES, PATENT,
1909 LEAKAGE, POLLUTION PREVENTION, SHIPS, OIL DISCHARGES, OIL SPILLS,
1659 LEGISLATION, COMPENSATION, NEW JERSEY, SPILL CLEANUP, OIL INDUSTRY, *SPILL FUND,
1908 LEGISLATION, LAW ENFORCEMENT, POLLUTION PREVENTION, OIL SPILLS, USCG,
1988 LEGISLATION, COMPENSATION, LIABILITY, TANKERS, OIL SPILLS, OIL INDUSTRY, *SPILL SUPERFUNDS,
1992 LEGISLATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CANADA, TANKERS, OIL SPILLS,
2053 LEGISLATION, ENVIRONMENTAL MANAGEMENT, COASTS, OIL INDUSTRY, LOUISIANA, US,
2108 LEGISLATION, COMPENSATION, US, OIL SPILLS, LIABILITY, SPILL CLEANUP, *COSTS,
2109 LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS, US, OCS, OFFSHORE DEVELOPMENT, REFINERIES,
2110 LEGISLATION, US, STATE GOVERNMENTS, OIL SPILLS, TANKERS, POLLUTION CONTROL,
2115 LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, POLLUTION CONTROL, OCEANS, UK, US,
2116 LEGISLATION, INTERNATIONAL CONVENTIONS, POLLUTION CONTROL,
2119 LEGISLATION, LAW ENFORCEMENT, ENGLAND, CANADA, SHIPS, OIL SPILLS,
2134 LEGISLATION, BIBLIOGRAPHIES, US, POLLUTION CONTROL,
1640 LIABILITY, ARGO MERCHANT SPILL, TANKERS, SPILL CLEANUP,
1902 LIABILITY, INTERNATIONAL CONVENTIONS, OIL SPILLS, TANKERS, OIL DISCHARGES, SAFETY, POLLUTION CONTROL,
1988 LIABILITY, LEGISLATION, COMPENSATION, TANKERS, OIL SPILLS, OIL INDUSTRY, *SPILL SUPERFUNDS,
1989 LIABILITY, ALASKA, OIL SPILLS, REGULATIONS, TANKERS, OIL TRANSFER, PORTS, *OIL SPILL FUND,
2108 LIABILITY, LEGISLATION, COMPENSATION, US, OIL SPILLS, SPILL CLEANUP, *COSTS,
2124 LIABILITY, INTERNATIONAL AGREEMENTS, OFFSHORE DRILLING, OIL TRANSFER, STORAGE, NORTH SEA,
1644 LOUISIANA, BLOWOUTS, OIL WELLS, *GAS-WELLS,
1800 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *BAYOU CHOCTAW SALT DOME,
2044 LOUISIANA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY, OFFSHORE DRILLING, OCS,
2053 LOUISIANA, LEGISLATION, ENVIRONMENTAL MANAGEMENT, COASTS, OIL INDUSTRY, US,
1840 LUBRICATING OIL, GASOLINE, FUEL OIL, ENVIRONMENTAL EFFECTS, WASTEWATERS, OIL DISCHARGES, MONITORING, *DISSOLVED ORGANICS,
1873 LUBRICATING OIL, FILTRATION, COALESCENCE, WASTE OIL, RECYCLING,
1874 LUBRICATING OIL, RECLAMATION, WASTE OILS, *IFP PROCESS,
1877 LUBRICATING OIL, FUELS, FILTRATION, WASTE OIL, RECLAMATION, OIL-WATER SEPARATION, *USCG POWER PLANTS,
1949 LUBRICATING OIL, FRESHWATER, FISH, CHRONIC EFFECTS, TOXICITY, *SYNTHETIC OIL,
2006 LUBRICATING OIL, BIOLOGICAL EFFECTS, BACTERIA, PETROLEUM PRODUCTS, MOVEMENT, SOIL,
1971 MAGELLAN/STRAIT OF, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, METULA SPILL, MARINE ORGANISMS,

1993 MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, SEDIMENTS,
2062 MAGELLAN/STRAIT OF, HYDROCARBONS, BIODEGRADATION, BEACHES, BACTERIA, SEDIMENT, METULA SPILL,
1984 MAINE, BIOLOGICAL EFFECTS, OIL SPILLS, MOLLUSKS, *GONADAL NEOPLASMS, *MYA ARENARIA,
1995 MALAYSIA, ENVIRONMENTAL EFFECTS, OIL SPILLS, TANKERS,
2122 MANUALS, GUIDELINES, CONTINGENCY PLANNING, POLLUTION PREVENTION, TANKERS,
2013 MARINE MAMMALS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,
1924 MARINE MAMMALS, HYDROCARBONS, CRUDE OIL, BIOLOGICAL EFFECTS, BEAUFORT SEA, UPTAKE, *RINGED SEAL,
1986 MARINE MAMMALS, CRUDE OIL, BIOLOGICAL EFFECTS, *THERMAL CONDUCTANCE, *SEA OTTERS, *PINNIPEDS,
2037 MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *MORTALITY,
1714 MARINE ORGANISMS, HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BASELINE STUDIES, SPECTROSCOPY,
1715 MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, SPECTROSCOPY, SPECTROMETRY,
1910 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, OIL SPILLS, TOXICITY,
1913 MARINE ORGANISMS, HYDROCARBONS, BEHAVIOR, ANALYTICAL TECHNIQUES, TOXICITY, METABOLISM, *SUBLETHAL LEVELS,
1916 MARINE ORGANISMS, DISPERSANTS, SPILL CLEANUP, OIL DISCHARGES, TOXICITY,
1927 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, SANTA BARBARA CHANNEL,
1937 MARINE ORGANISMS, CHESAPEAKE BAY, BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MOLLUSKS, *MARSH GRASSES,
1947 MARINE ORGANISMS, HYDROCARBONS, UPTAKE, STORAGE, RELEASE,
1951 MARINE ORGANISMS, HYDROCARBONS, ECOSYSTEMS, BIOLOGICAL EFFECTS, ARCTIC, SUBARCTIC REGIONS,
1959 MARINE ORGANISMS, HYDROCARBONS, DETECTION, CANADA, METABOLISM, MONITORING, *ENZYME ACTIVITY,
1962 MARINE ORGANISMS, FUEL OIL, CRUDE OIL, TOXICITY, UPTAKE, RELEASE,
1964 MARINE ORGANISMS, CRUDE OIL, TOXICITY, PETROLEUM PRODUCTS, *COMPARATIVE TOXICITY , *BIOASSAY,
1971 MARINE ORGANISMS, MAGELLAN/STRAIT OF, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, METULA SPILL,
1977 MARINE ORGANISMS, INTERTIDAL ZONE, CHEDABUCTO BAY, CANADA, OIL SPILLS, TOXICITY, *MORTALITIES,
1996 MARINE ORGANISMS, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, DISPERSANTS, OIL SPILLS, SHORELINES, TOXICITY,
1998 MARINE ORGANISMS, FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SHIPS, PRODUCTION , SEABIRDS, SPILL CLEANUP,
2000 MARINE ORGANISMS, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, SOURCES, POLLUTION CONTROL,
2005 MARINE ORGANISMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, CONTAMINATION, CHRONIC EFFECTS, OIL SPILLS,
2041 MARINE ORGANISMS, CALIFORNIA/SOUTHERN, OFFSHORE DRILLING, PLATFORMS, UPTAKE, SEDIMENTS,
2076 MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, ARCTIC, METABOLISM, SUBARCTIC REGIONS, TOXICITY,
2091 MARINE ORGANISMS, HYDROCARBONS, FUEL OIL, ESTUARIES, SEDIMENTS, VIRGINIA,
2101 MARINE ORGANISMS, HYDROCARBONS, FATE, SEAWATER, *MOLECULAR INTERACTIONS,
2133 MARINE ORGANISMS, ESTUARIES, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES,
2136 MARINE ORGANISMS, CONTAMINATION, CARIBBEAN SEA, BIBLIOGRAPHIES,
1791 MARSHES, FRESHWATER, DISPOSAL , DISPERSANTS, COASTS, BEACHES, ABSORPTION, SPILL CLEANUP, SEAWATER,
1793 MARSHES, ENGLAND, CONTAMINATION, RESTORATION, VEGETATION, WASTEWATERS, REFINERIES, *SALT MARSH,
1925 MARSHES, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, *SALTMARSH,
1937 MARSHES, MARINE ORGANISMS, CHESAPEAKE BAY, BIRDS, BIOLOGICAL EFFECTS, OIL SPILLS, MOLLUSKS, *MARSH GRASSES,
1944 MARSHES, FUEL OIL, CRUSTACEANS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL SPILLS, MASSACHUSETTS, *UCA PUGNAX,
1999 MARSHES, ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, OIL SPILLS, VEGETATION, SOIL,
1944 MASSACHUSETTS, MARSHES, FUEL OIL, CRUSTACEANS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL SPILLS, *UCA PUGNAX,
2125 MEDITERRANEAN SEA, INTERNATIONAL CONVENTIONS, BIOLOGICAL EFFECTS, UN, POLLUTION CONTROL, MONITORING,
1913 METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BEHAVIOR, ANALYTICAL TECHNIQUES, TOXICITY, *SUBLETHAL LEVELS,
1942 METABOLISM, FISH, PETROLEUM PRODUCTS, TOXICITY, *SPICARA SMARIS, *SOLEA LASCARIS NASUTA,
1945 METABOLISM, FUEL OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, *TEMPERATURE, *SALINITY, *LIMULUS POLYPHEMUS,
1956 METABOLISM, HYDROCARBONS, BIOLOGICAL EFFECTS, PHYTOPLANKTON, *PLANT GROWTH, *PHOTOSYNTHESIS,

1959 METABOLISM, MARINE ORGANISMS, HYDROCARBONS, DETECTION, CANADA, MONITORING, *ENZYME
ACTIVITY,
1960 METABOLISM, DISPERSIONS, CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, *SUBLETHAL
EFFECTS, *ARCTIC AMPHIPOD,
1963 METABOLISM, HYDROCARBONS, FUEL OIL, FISH, CRUDE OIL, TOXICITY,*RESPIRATION,
*ONCORHYNCHUS GORBUSCHA,
1974 METABOLISM, HYDROCARBONS, FUEL OIL, CRUSTACEANS, UPTAKE, *NAPHTHALENES, *HATCHING,
*LARVAL GROWTH, *GRASS SHRIMP,
2076 METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, ARCTIC, SUBARCTIC REGIONS,
TOXICITY,
1971 METULA SPILL, MARINE ORGANISMS, MAGELLAN/STRAIT OF, INTERTIDAL ZONE, BIOLOGICAL
EFFECTS,
1993 METULA SPILL, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, BEACHES, SEDIMENTS,
2062 METULA SPILL, MAGELLAN/STRAIT OF, HYDROCARBONS, BIODEGRADATION, BEACHES, BACTERIA,
SEDIMENT,
1671 MEXICO/GULF OF, HYDROCARBONS, MONITORING, SOURCES, PLATFORMS, *GAS VENTING, *BRINE
SCHARGE,
676 MEXICO/GULF OF, HYDROCARBONS, MONITORING, SEDIMENTS, SOURCES, *CONTINENTAL SHELF,
1698 MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, SEAWATER, OIL-GAS LEASING,
*SEASONAL VARIATIONS, *MAFLA LEASE AREA,
2024 MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING, OCS,
2025 MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING, OCS,
1673 MICROORGANISMS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA,
MONITORING, MOVEMENT, *PERMAFROST TERRAIN,
1923 MICROORGANISMS, FUEL OIL, CRUDE OIL, CANADA, BIOLOGICAL EFFECTS, *GEORGIA STRAIT,
*HETEROTROPHIC POTENTIAL, *PRODUCTIVITY,
1925 MICROORGANISMS, MARSHES, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, BIODEGRADATION,
*SALTMARSH,
1957 MICROORGANISMS, INTERTIDAL ZONE, BIOMASS, BIOLOCICAL EFFECTS, BACTERIA, SEDIMENTS,
2057 MICROORGANISMS, BIODEGRADATION, ARCTIC OCEAN, *14C-DODECANE OXIDATION , *PORT VALDEZ,
2058 MICROORGANISMS, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, ARCTIC,
2068 MICROORGANISMS, BIODEGRADATION, AROMATIC HYDROCARBONS , SOURCES,
2070 MICROORGANISMS, BIODEGRADATION, ARCTIC OCEAN, OIL SLICKS, *CONTINUOUS FLOW-THROUGH
YSTEM,
2071 MICROORGANISMS, LAKES, HYDROCARBONS, GASOLINE, BIODEGRADATION, ALASKA, SEDIMENTS,
2072 MICROORGANISMS, LAKES, GASOLINE, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC,
2107 MICROORGANISMS, FUEL OIL, DECOMPOSITION, BIODEGRADATION, *PHYSICOCHEMICAL DEGRADATION,
2128 MICROORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, ANIMALS, OIL SPILLS, PLANTS,
2087 MODELS, EVAPORATION, DELAWARE BAY, OIL SPILLS, WEATHERING, OIL TRANSFER,
2088 MODELS, FATE, OIL SPILLS, OXIDATION, *N-HEXADECANE, *PHOTOOXIDATION ,
2094 MODELS, INTERTIDAL ZONE, FATE, DISTRIBUTION, BIODEGRADATION, BALTIC SEA, OIL SPILLS,
MODELS, BEHAVIOR, OIL SLICKS, PHYSICAL EFFECTS, *WIND-CURRENT EFFECTS,
1699 MOLLUSKS, ESTUARIES, DETECTION, CARCINOGENS, SAMPLING, PAH, OREGON, *BIVALVES,
1794 MOLLUSKS, ENGLAND, BIOLOGICAL EFFECTS, ALGAE, RESTORATION, SHORELINES, OIL SPILLS,
*ROCKY SHORES,
1928 MOLLUSKS, BIOLOGICAL EFFECTS, *PHENOL, *CYTOLOGY, *MERCENARIA MERCENARIA,
1929 MOLLUSKS, CRUDE OIL, UPTAKE, RELEASE, *NAPHTHALENES, *RANGEA CUNEATA, *PROTOTHACA
MINEA,
1937 MOLLUSKS, MARSHES, MARINE ORGANISMS, CHESAPEAKE BAY, BIRDS, BIOLOGICAL EFFECTS, OIL
SPILLS, *MARSH GRASSES,
1965 MOLLUSKS, HYDROCARBONS, EMULSIFIERS, CRUDE OIL, BIBLIOGRAPHIES, TOXICITY, SURFACTANTS,
*MUSSELS,
1966 MOLLUSKS, FUEL OIL, EMULSIONS, UPTAKE, RELEASE, *MYA ARENARIA L.,
1975 MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, SEAWATER, SEDIMENTS, *WATER-SOLUBLE FRACTION,
*OIL-TREATED SEDIMENT, *MACOMA BALTHICA,
1979 MOLLUSKS, TOXICITY, UPTAKE, RELEASE, *OIL DROPLETS, *MORTALITY, *CRASSOSTREA GIGAS,
*MYTILUS SPP.,
1981 MOLLUSKS, UPTAKE, PETROLEUM PRODUCTS, SEAWATER, *WATER PURIFICATION, *MYTILUS EDULIS,
984 MOLLUSKS, MAINE, BIOLOGICAL EFFECTS, OIL SPILLS, *GONADAL NEOPLASMS, *MYA ARENARIA,
1641 MONITORING, ARGO MERCHANT SPILL, MOVEMENT, POLLUTION PREVENTION, TANKERS, USGS,
1664 MONITORING, FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, OIL SPILLS, SPILL CLEANUP, *1977
OIL SPILL CONFERENCE,
1667 MONITORING, CONTAMINANTS, ANALYTICAL TECHNIQUES, SAMPLING,
1668 MONITORING, CHESAPEAKE BAY, ARGO MERCHANT SPILL,
1669 MONITORING, DESIGN-ENGINEERING, POLLUTION CONTROL,
1670 MONITORING, CHEMICAL ANALYSIS, OIL SPILLS, WASTE OIL, *IR ABSORPTION ,
1671 MONITORING, MEXICO/GULF OF, HYDROCARBONS, SOURCES, PLATFORMS, *GAS VENTING, *BRINE
DISCHARGE,
1672 MONITORING, HYDROCARBONS, DISTRIBUTION, CHRONIC EFFECTS, AUSTRALIA, SOURCES, *MYTILUS
EDULIS, *INDICATOR SPECIES,
1673 MONITORING, MICROORGANISMS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS,
ALASKA, MOVEMENT, *PERMAFROST TERRAIN,
1674 MONITORING, DETECTION, DESIGN-ENGINEERING, OIL SPILLS, *BUOYS, *GAS SENSORS,
1675 MONITORING, POLLUTION CONTROL, OIL-WATER SEPARATION, SHIPS, *ULTRASONIC MONITOR,
1676 MONITORING, INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, ALASKA

COAST, OFFSHORE DEVELOPMENT, OCS, NOAA,
1677 MONITORING, DESIGN-ENGINEERING, CHROMATOGRAPHY, SOURCE IDENTIFICATION, *INSTRUMENT SURVEY,
1678 MONITORING, MEXICO/GULF OF, HYDROCARBONS, SEDIMENTS, SOURCES, *CONTINENTAL SHELF,
1679 MONITORING, HYDROCARBONS, ENVIRONMENTAL EFFECTS, OIL TRANSPORT, PIPELINES, REFINERIES, PUGET SOUND,
1680 MONITORING, DESIGN-ENGINEERING, OIL DISCHARGES, TANKERS, REGULATIONS, PATENT,
1681 MONITORING, STREAMS, SEDIMENTS, WASTEWATERS, REFINERIES, SAMPLING, *HEAVY METALS,
1682 MONITORING, PETROLEUM PRODUCTS, OXIDATION, SEAWATER, *CHEMILUMINESCENCE,
1683 MONITORING, DISPERSIONS, DETECTION, PATENT, *OIL SOLUBLE DYE,
1684 MONITORING, DETECTION, DESIGN-ENGINEERING, BILGES, SHIPS,
1685 MONITORING, DESIGN-ENGINEERING, BILGES, *TOTAL ORGANIC CARBON DETERMINATION,
1686 MONITORING, LEAKAGE, DETECTION, PIPELINES,
1688 MONITORING, REMOTE SENSING, OIL SLICKS, POLLUTION CONTROL, *LANDSAT,
1691 MONITORING, DETECTION, COASTS, REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, *LANDSAT DATA,
1692 MONITORING, ENVIRONMENTAL EFFECTS, CONTAMINANTS, REMOTE SENSING, OIL SPILLS,
1717 MONITORING, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , SEDIMENTS, *GLASS CAPILLARY COLUMNS,
1840 MONITORING, LUBRICATING OIL, GASOLINE, FUEL OIL, ENVIRONMENTAL EFFECTS, WASTEWATERS, OIL DISCHARGES, *DISSOLVED ORGANICS,
1946 MONITORING, INVERTEBRATES, FRESHWATER, REFINERIES, TOXICITY, WASTEWATERS, *DAPHNIA PULEX, *BIOASSAY,
1959 MONITORING, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, DETECTION, CANADA, *ENZYME ACTIVITY,
2039 MONITORING, INDUSTRIES, ENVIRONMENTAL EFFECTS, OIL SHALE, *R & D NEEDS,
2075 MONITORING, FUNGI, BIODEGRADATION, BACTERIA, WASTE OIL, SOIL, *ARID SITE,
2090 MONITORING, ENVIRONMENTAL EFFECTS, BEHAVIOR, ARGO MERCHANT SPILL, MOVEMENT, SAMPLING,
2125 MONITORING, MEDITERRANEAN SEA, INTERNATIONAL CONVENTIONS, BIOLOGICAL EFFECTS, UN, POLLUTION CONTROL,
2135 MONITORING, DETECTION, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SAMPLING, REMOTE SENSING,
1641 MOVEMENT, MONITORING, ARGO MERCHANT SPILL, POLLUTION PREVENTION, TANKERS, USGS,
1673 MOVEMENT, MONITORING, MICROORGANISMS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA, *PERMAFROST TERRAIN,
1695 MOVEMENT, COASTS, REMOTE SENSING, OIL SLICKS, WASTEWATERS, *CURRENT CIRCULATION, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
2006 MOVEMENT, LUBRICATING OIL, BIOLOGICAL EFFECTS, BACTERIA, PETROLEUM PRODUCTS, SOIL,
2090 MOVEMENT, MONITORING, ENVIRONMENTAL EFFECTS, BEHAVIOR, ARGO MERCHANT SPILL, SAMPLING,
2095 MOVEMENT, ALASKA, OIL SPILLS, *COASTAL WINDS,
2096 MOVEMENT, BEAUFORT SEA, ALASKA COAST, OIL SPILLS, SHORELINES, *SPILL IMPACT PROBABILITY,
2103 MOVEMENT, OIL SLICKS, *LEEWAY, *WIND DRIFT,
2106 MOVEMENT, JAPAN, PETROLEUM PRODUCTS, SEDIMENTS, *SETO INLAND SEA,
1687 NATURAL SEEPAGE, REMOTE SENSING, OIL SLICKS, POLLUTION CONTROL, *LANDSAT,
1691 NATURAL SEEPAGE, MONITORING, DETECTION, COASTS, REMOTE SENSING, OIL SLICKS, *LANDSAT DATA,
1694 NATURAL SEEPAGE, DETECTION, REMOTE SENSING, OIL SLICKS, SURVEILLANCE, SANTA BARBARA CHANNEL, *COASTAL ZONE COLOR SCANNER,
1722 NATURAL SEEPAGE, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, BIODEGRADATION, WEATHERING, SPECTROMETRY, SANTA BARBARA CHANNEL,
1731 NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS, SOURCE IDENTIFICATION, OIL DISCHARGES, OIL SPILLS, OFFSHORE DEVELOPMENT, TANKERS,
1659 NEW JERSEY, LEGISLATION, COMPENSATION, SPILL CLEANUP, OIL INDUSTRY, *SPILL FUND,
2048 NEW JERSEY, FISHERIES, ENVIRONMENTAL EFFECTS, DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, PORTS,
1940 NEW YORK, CRUDE OIL, BENTHOS, TOXICITY, PLANKTON , OCS, *NEW YORK BIGHT,
1676 NOAA, MONITORING, INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, ALASKA COAST, OFFSHORE DEVELOPMENT, OCS,
1637 NORTH SEA, OIL SPILLS, STATISTICS, SOURCES, UK,
1642 NORTH SEA, BLOWOUTS, POLLUTION CONTROL, NORWAY, *EMERGENCY VESSEL,
1643 NORTH SEA, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, PRODUCTION ,
1647 NORTH SEA, FISH, EKOFISK BLOWOUT, OIL SPILLS,
1652 NORTH SEA, BLOWOUT PREVENTION, NORWAY, *RED ADAIR CO.,
1654 NORTH SEA, EKOFISK BLOWOUT, OIL SPILLS, SPILL CLEANUP, POLLUTION CONTROL,
1655 NORTH SEA, ENVIRONMENTAL PROTECTION, OIL SPILLS, OIL TRANSFER, TANKERS, SURVEILLANCE,
1658 NORTH SEA, ENVIRONMENTAL PROTECTION, EKOFISK BLOWOUT, WILDLIFE,
1665 NORTH SEA, EKOFISK BLOWOUT, POLLUTION CONTROL,
1744 NORTH SEA, BOOMS, BLOWOUTS, SPILL RECOVERY, NORWAY,
1751 NORTH SEA, DESIGN-ENGINEERING, SPILL RECOVERY, *OIL COLLECTION SYSTEMS,
1904 NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS, BLOWOUTS, STATISTICAL ANALYSIS,
2002 NORTH SEA, FISHERIES, BIRDS, OIL SPILLS, REFINERIES, OIL TRANSPORT, OFFSHORE PRODUCTION, POLLUTION CONTROL, TOXICITY,
2003 NORTH SEA, FISHERIES, CRUDE OIL, AROMATIC HYDROCARBONS , OFFSHORE DEVELOPMENT,
2012 NORTH SEA, FISHERIES, OIL INDUSTRY, OFFSHORE DEVELOPMENT, SCOTLAND,
2020 NORTH SEA, ENVIRONMENTAL PROTECTION, EKOFISK BLOWOUT, OFFSHORE DEVELOPMENT, SAFETY,

REGULATIONS,
2124 NORTH SEA, LIABILITY, INTERNATIONAL AGREEMENTS, OFFSHORE DRILLING, OIL TRANSFER,
STORAGE,
1635 NORWAY, EKOFISK BLOWOUT, COST ANALYSIS, OFFSHORE DRILLING, OFFSHORE EXPLORATION,
1642 NORWAY, NORTH SEA, BLOWOUTS, POLLUTION CONTROL, *EMERGENCY VESSEL,
1645 NORWAY, BLOWOUTS, OIL SPILLS, *PREDICTION,
1652 NORWAY, NORTH SEA, BLOWOUT PREVENTION, *RED ADAIR CO.,
1744 NORWAY, NORTH SEA, BOOMS, BLOWOUTS, SPILL RECOVERY,
2026 NORWAY, CHEMICAL ANALYSIS, PETROCHEMICALS, WASTEWATER TREATMENT, POLLUTION CONTROL,
2093 NORWAY, FISH, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BIODEGRADATION, AROMATIC
HYDROCARBONS , OIL SPILLS, WEATHERING, *T/T "DRUPA" SPILL,
1648 OCEANS, DISTRIBUTION, CANADA, ATLANTIC OCEAN, TAR, SARGASSO SEA,
1657 OCEANS, COASTS, ALASKA, OIL SPILLS, STATISTICS,
1662 OCEANS, OIL SPILLS, TANKERS, STATISTICS, *TANKER ACCIDENTS,
1689 OCEANS, REMOTE SENSING, OIL SLICKS, SURVEILLANCE, *DYS/SLICK SEAMARKING DEVICE,
1696 OCEANS, REMOTE SENSING, OIL SLICKS, *WAVE DAMPING, *OIL PROPERTIES,
1697 OCEANS, BIBLIOGRAPHIES, REMOTE SENSING, OIL SLICKS, *RADAR, *SEA SURFACE,
1702 OCEANS, CONTAMINATION, PETROLEUM PRODUCTS, *LASER RADAR, *SEA SURFACE,
1739 OCEANS, FRESHWATER, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
1776 OCEANS, ABSORPTION, SPILL CLEANUP, *POLYURETHANE FOAMS,
1906 OCEANS, INLAND, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, OIL SPILLS, SPILL CLEANUP,
1976 OCEANS, HYDROCARBONS, FOOD WEB, UPTAKE, RELEASE, *FOOD CHAIN TRANSFER,
2000 OCEANS, MARINE ORGANISMS, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES,
POLLUTION CONTROL,
2008 OCEANS, HYDROCARBONS, HEALTH HAZARDS, CONTAMINATION, BIOLOGICAL EFFECTS, POLLUTION
CONTROL,
2056 OCEANS, FATE, DRILLING , BIOLOGICAL EFFECTS, *DRILL CUTTINGS,
2115 OCEANS, LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, POLLUTION
CONTROL, UK, US,
1676 OCS, NOAA, MONITORING, INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, BLM, BASELINE
STUDIES, ALASKA COAST, OFFSHORE DEVELOPMENT,
1865 OCS, CONTINGENCY PLANNING, CALIFORNIA/SOUTHERN, OIL INDUSTRY, OIL-GAS LEASING,
1940 OCS, NEW YORK, CRUDE OIL, BENTHOS, TOXICITY, PLANKTON , *NEW YORK BIGHT,
1967 OCS, HYDROCARBONS, CONTAMINATION, ATLANTIC COAST, OIL DISCHARGES, PHYTOPLANKTON,
2013 OCS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT,
MARINE MAMMALS,
2014 OCS, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, OFFSHORE
DEVELOPMENT, PLANKTON ,
2021 OCS, FOSSIL FUELS , ENVIRONMENTAL MANAGEMENT, OFFSHORE DRILLING, REGULATIONS,
POLLUTION CONTROL,
2022 OCS, CRUDE OIL, ALASKA, OFFSHORE DRILLING, SOCIO-ECONOMIC EFFECTS, *SEA GRANT PROGRAM,
*ENERGY POLICY,
2024 OCS, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING.
2025 OCS, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS, OIL-GAS LEASING,
2027 OCS, ENVIRONMENTAL EFFECTS, BERING SEA, ALASKA/GULF OF, OFFSHORE EXPLORATION, OIL-GAS
LEASING,
2033 OCS, ENVIRONMENTAL EFFECTS, EIS, ALASKA, OIL-GAS LEASING, SOCIO-ECONOMIC EFFECTS,
2037 OCS, MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, *MORTALITY,
2038 OCS, HYDROCARBONS, CHEMICAL ANALYSIS, BASELINE STUDIES, ATLANTIC COAST, OFFSHORE
DEVELOPMENT,
2043 OCS, ENVIRONMENTAL EFFECTS, BLM, OFFSHORE DEVELOPMENT,
2044 OCS, LOUISIANA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY, OFFSHORE
DRILLING,
2045 OCS, ENVIRONMENTAL EFFECTS, CRUDE OIL, ALASKA, OFFSHORE DEVELOPMENT, OIL-GAS LEASING,
2051 OCS, LABRADOR SEA, ICE, OFFSHORE DEVELOPMENT, SAFETY, *MINING TECHNOLOGY,
2052 OCS, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, POLLUTION
PREVENTION,
2055 OCS, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, US, SOCIO-ECONOMIC EFFECTS,
STATE GOVERNMENTS,
2109 OCS, LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS, US, OFFSHORE DEVELOPMENT, REFINERIES,
1649 OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, STATISTICS, POLLUTION CONTROL, *DATA BANK,
UK,
1676 OFFSHORE DEVELOPMENT, OCS, NOAA, MONITORING, INFORMATION SYSTEMS, ENVIRONMENTAL
EFFECTS, BLM, BASELINE STUDIES, ALASKA COAST,
1731 OFFSHORE DEVELOPMENT, NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS, SOURCE
IDENTIFICATION, OIL DISCHARGES, OIL SPILLS, TANKERS,
2003 OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES, CRUDE OIL, AROMATIC HYDROCARBONS ,
2012 OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES, OIL INDUSTRY, SCOTLAND,
2013 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,
MARINE MAMMALS,
2014 OFFSHORE DEVELOPMENT, OCS, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES,
ALASKA, PLANKTON ,
2015 OFFSHORE DEVELOPMENT, HABITAT, ENVIRONMENTAL EFFECTS, BIRDS, ARCTIC, ALASKA,
SHORELINES, *SHOREBIRD SPECIES,
2016 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,

SHORELINES, OIL SPILLS,
2020 OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL PROTECTION, EKOFISK BLOWOUT, SAFETY, REGULATIONS,
2029 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING,
2031 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING,
2032 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES, OIL-GAS LEASING,
2034 OFFSHORE DEVELOPMENT, ICE, ENVIRONMENTAL EFFECTS, CANADA, ARCTIC, OFFSHORE EXPLORATION, OIL INDUSTRY,
2037 OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, *MORTALITY,
2038 OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, CHEMICAL ANALYSIS, BASELINE STUDIES, ATLANTIC COAST,
2043 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BLM,
2045 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, CRUDE OIL, ALASKA, OIL-GAS LEASING,
2046 OFFSHORE DEVELOPMENT, GUIDELINES, ENVIRONMENTAL MANAGEMENT, COASTS, *CZM,
2047 OFFSHORE DEVELOPMENT, ENVIRONMENTAL DETERIORATION, ATLANTIC COAST, PORTS,
2048 OFFSHORE DEVELOPMENT, NEW JERSEY, FISHERIES, ENVIRONMENTAL EFFECTS, DELAWARE, ATLANTIC COAST, PORTS,
2051 OFFSHORE DEVELOPMENT, OCS, LABRADOR SEA, ICE, SAFETY, *MINING TECHNOLOGY,
2052 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, COASTS, ONSHORE IMPACTS, POLLUTION PREVENTION,
2054 OFFSHORE DEVELOPMENT, ICE, ENVIRONMENTAL EFFECTS, ARCTIC, *ICE COVERED WATERS, *RESEARCH TECHNOLOGY,
2055 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, COASTS, US, SOCIO-ECONOMIC EFFECTS, STATE GOVERNMENTS,
2109 OFFSHORE DEVELOPMENT, OCS, LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS, US, REFINERIES,
1635 OFFSHORE DRILLING, NORWAY, EKOFISK BLOWOUT, COST ANALYSIS, OFFSHORE EXPLORATION,
1686 OFFSHORE DRILLING, EMULSIONS, DESIGN-ENGINEERING, POLLUTION PREVENTION, *DRILLING MUDS,
1691 OFFSHORE DRILLING, GREENLAND, ARCTIC, SAFETY, POLLUTION PREVENTION, *ICEBERGS,
2021 OFFSHORE DRILLING, OCS, FOSSIL FUELS , ENVIRONMENTAL MANAGEMENT, REGULATIONS, POLLUTION CONTROL,
2022 OFFSHORE DRILLING, OCS, CRUDE OIL, ALASKA, SOCIO-ECONOMIC EFFECTS, *SEA GRANT PROGRAM, *ENERGY POLICY,
2041 OFFSHORE DRILLING, MARINE ORGANISMS, CALIFORNIA/SOUTHERN, PLATFORMS, UPTAKE, SEDIMENTS,
2042 OFFSHORE DRILLING, FISH, ENVIRONMENTAL EFFECTS, CONTAMINANTS, COASTS,
2044 OFFSHORE DRILLING, OCS, LOUISIANA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY,
2124 OFFSHORE DRILLING, NORTH SEA, LIABILITY, INTERNATIONAL AGREEMENTS, OIL TRANSFER, STORAGE,
1635 OFFSHORE EXPLORATION, OFFSHORE DRILLING, NORWAY, EKOFISK BLOWOUT, COST ANALYSIS,
2027 OFFSHORE EXPLORATION, OCS, ENVIRONMENTAL EFFECTS, BERING SEA, ALASKA/GULF OF, OIL-GAS LEASING,
2034 OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, ICE, ENVIRONMENTAL EFFECTS, CANADA, ARCTIC, OIL INDUSTRY,
1704 OFFSHORE PRODUCTION, CHEMICAL ANALYSIS, SEDIMENTS, VENEZUELA, STATISTICAL ANALYSIS,
2002 OFFSHORE PRODUCTION, NORTH SEA, FISHERIES, BIRDS, OIL SPILLS, REFINERIES, OIL TRANSPORT, POLLUTION CONTROL, TOXICITY,
1844 OHIO, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, REFINERIES, SOLID WASTES, *UPFLOW SAND FILTERS,
1636 OIL DISCHARGES, DISTILLATION, POLLUTION CONTROL, OIL-WATER SEPARATION, USSR,
1680 OIL DISCHARGES, MONITORING, DESIGN-ENGINEERING, TANKERS, REGULATIONS, PATENT,
1731 OIL DISCHARGES, OFFSHORE DEVELOPMENT, NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS, SOURCE IDENTIFICATION, OIL SPILLS, TANKERS,
1840 OIL DISCHARGES, MONITORING, LUBRICATING OIL, GASOLINE, FUEL OIL, ENVIRONMENTAL EFFECTS, WASTEWATERS, *DISSOLVED ORGANICS,
1902 OIL DISCHARGES, LIABILITY, INTERNATIONAL CONVENTIONS, OIL SPILLS, TANKERS, SAFETY, POLLUTION CONTROL,
1909 OIL DISCHARGES, LEAKAGE, POLLUTION PREVENTION, SHIPS, OIL SPILLS,
1916 OIL DISCHARGES, MARINE ORGANISMS, DISPERSANTS, SPILL CLEANUP, TOXICITY,
1967 OIL DISCHARGES, OCS, HYDROCARBONS, CONTAMINATION, ATLANTIC COAST, PHYTOPLANKTON,
2111 OIL DISCHARGES, EIS, OIL TRANSPORT, TANKERS, US, REGULATIONS, POLLUTION CONTROL,
2112 OIL DISCHARGES, EIS, OIL TRANSPORT, TANKERS, SEGREGATED BALLAST , REGULATIONS, US, POLLUTION CONTROL,
2114 OIL DISCHARGES, REGULATIONS, TANKERS, WASTEWATERS, USCG,
2126 OIL DISCHARGES, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO, TANKERS,
1698 OIL-GAS LEASING, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, SEAWATER, *SEASONAL VARIATIONS, *MAFLA LEASE AREA,
1685 OIL-GAS LEASING, OCS, CONTINGENCY PLANNING, CALIFORNIA/SOUTHERN, OIL INDUSTRY,
2024 OIL-GAS LEASING, OCS, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS,
2025 OIL-GAS LEASING, OCS, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, EIS,
2027 OIL-GAS LEASING, OFFSHORE EXPLORATION, OCS, ENVIRONMENTAL EFFECTS, BERING SEA, ALASKA/GULF OF,
2028 OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES,

2029 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES,
2030 OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES,
2031 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES,
2032 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA/SOUTHERN, BASELINE STUDIES,
2033 OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, EIS, ALASKA, SOCIO-ECONOMIC EFFECTS,
2045 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, CRUDE OIL, ALASKA,
1659 OIL INDUSTRY, NEW JERSEY, LEGISLATION, COMPENSATION, SPILL CLEANUP, *SPILL FUND,
1837 OIL INDUSTRY, GERMANY, EAST, REFINERIES, PETROCHEMICALS, WASTEWATER TREATMENT,
1865 OIL INDUSTRY, WASTEWATER TREATMENT, OXIDATION,
1885 OIL INDUSTRY, OIL-GAS LEASING, OCS, CONTINGENCY PLANNING, CALIFORNIA/SOUTHERN,
1898 OIL INDUSTRY, CONTINGENCY PLANNING, SPILL CLEANUP, PUGET SOUND, *OIL SPILL COOPERATIVE,
1967 OIL INDUSTRY, COST ANALYSIS, API, REGULATIONS, POLLUTION CONTROL, WASTEWATER TREATMENT, REFINERIES,
1988 OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, TANKERS, OIL SPILLS, *SPILL SUPERFUNDS,
1990 OIL INDUSTRY, EPA, ECONOMIC EFFECTS, COST ANALYSIS, API, REGULATIONS, POLLUTION CONTROL,
2012 OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES, SCOTLAND,
2018 OIL INDUSTRY, COST ANALYSIS, REGULATIONS, US, WATER QUALITY, POLLUTION PREVENTION,
2019 OIL INDUSTRY, ECONOMIC EFFECTS, COST ANALYSIS, REGULATIONS, POLLUTION PREVENTION,
2023 OIL INDUSTRY, ENVIRONMENTAL EFFECTS, REFINING, POLLUTION CONTROL, *TECHNOLOGY ASSESSMENT,
2034 OIL INDUSTRY, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, ICE, ENVIRONMENTAL EFFECTS, CANADA, ARCTIC,
2044 OIL INDUSTRY, OFFSHORE DRILLING, OCS, LOUISIANA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,
2049 OIL INDUSTRY, ESTUARIES, DEVELOPMENT , CONTAMINATION, COASTS,
2050 OIL INDUSTRY, ENVIRONMENTAL EFFECTS, PETROCHEMICALS, REFINERIES,
2053 OIL INDUSTRY, LOUISIANA, LEGISLATION, ENVIRONMENTAL MANAGEMENT, COASTS, US,
2011 OIL SHALE, HEALTH HAZARDS, EXTRACTION, CARCINOGENS, *BENZO(A)PYRENE,
2039 OIL SHALE, MONITORING, INDUSTRIES, ENVIRONMENTAL EFFECTS, *R & D NEEDS,
2040 OIL SHALE, FOSSIL FUELS , ENVIRONMENTAL EFFECTS, PRODUCTION , TAR SANDS,
2065 OIL SHALE, HYDROCARBONS, BIODEGRADATION, BACTERIA,
2129 OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES,
2130 OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES,
2131 OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, POLLUTION CONTROL,
2132 OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIBLIOGRAPHIES, POLLUTION CONTROL,
1687 OIL SLICKS, NATURAL SEEPAGE, REMOTE SENSING, POLLUTION CONTROL, *LANDSAT,
1688 OIL SLICKS, MONITORING, REMOTE SENSING, POLLUTION CONTROL, *LANDSAT,
1689 OIL SLICKS, OCEANS, REMOTE SENSING, SURVEILLANCE, *DYS/SLICK SEAMARKING DEVICE,
1691 OIL SLICKS, NATURAL SEEPAGE, MONITORING, DETECTION, COASTS, REMOTE SENSING, *LANDSAT DATA,
1694 OIL SLICKS, NATURAL SEEPAGE, DETECTION, REMOTE SENSING, SURVEILLANCE, SANTA BARBARA CHANNEL, *COASTAL ZONE COLOR SCANNER,
1695 OIL SLICKS, MOVEMENT, COASTS, REMOTE SENSING, WASTEWATERS, *CURRENT CIRCULATION, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1696 OIL SLICKS, OCEANS, REMOTE SENSING, *WAVE DAMPING, *OIL PROPERTIES,
1697 OIL SLICKS, OCEANS, BIBLIOGRAPHIES, REMOTE SENSING, *RADAR, *SEA SURFACE,
1703 OIL SLICKS, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, SEAWATER, *SORBENTS,
1738 OIL SLICKS, BOOMS, BEHAVIOR, SPILL CONTAINMENT, *SLICK DROPLET FORMATION, *ENTRAINMENT FAILURE,
1752 OIL SLICKS, DISPERSANTS, BOOMS, SPILL CLEANUP, *PUMPS,
1779 OIL SLICKS, DISPERSANTS, DESIGN-ENGINEERING, SPILL CLEANUP, PATENT,
1782 OIL SLICKS, ABSORPTION, SPILL RECOVERY, PATENT,
1785 OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY, PATENT,
1788 OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, SHIPS, PATENT,
1918 OIL SLICKS, CHRONIC EFFECTS, BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS, OIL SPILLS,
1985 OIL SLICKS, *DETERGENTS, PHYSICAL EFFECTS, SEAWATER, *SEA SPRAY FORMATION,
2010 OIL SLICKS, ENVIRONMENTAL EFFECTS, DISPERSANTS, PHYTOPLANKTON, TOXICITY, *LIGHT REDUCTION, *PHOTOSYNTHESIS,
2063 OIL SLICKS, HYDROCARBONS, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS , YEASTS, *CHLORINATED HYDROCARBONS ,
2070 OIL SLICKS, MICROORGANISMS, BIODEGRADATION, ARCTIC OCEAN, *CONTINUOUS FLOW-THROUGH SYSTEM,
2102 OIL SLICKS, INTERTIDAL ZONE, HYDROCARBONS, ALASKA, UPTAKE, RELEASE, SEDIMENTS,
2103 OIL SLICKS, MOVEMENT, *LEEWAY, *WIND DRIFT,
2104 OIL SLICKS, MODELS, BEHAVIOR, PHYSICAL EFFECTS, *WIND-CURRENT EFFECTS,
1634 OIL SPILLS, FATE, EKOFISK BLOWOUT, CRUDE OIL,
1637 OIL SPILLS, NORTH SEA, STATISTICS, SOURCES, UK,
1639 OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, REGULATIONS, OIL TRANSFER, SCOTLAND,

1645 OIL SPILLS, NORWAY, BLOWOUTS, *PREDICTION,
1646 OIL SPILLS, ECONOMICS, TANKERS, SAFETY, *LIBERIAN REGISTRY,
1647 OIL SPILLS, NORTH SEA, FISH, EKOFISK BLOWOUT,
1651 OIL SPILLS, CRUDE OIL, ALASKA, PIPELINES, *PUMP STATION ACCIDENT,
1653 OIL SPILLS, CRUDE OIL, ALASKA, PIPELINES, *PUMP STATION ACCIDENT,
1654 OIL SPILLS, NORTH SEA, EKOFISK BLOWOUT, SPILL CLEANUP, POLLUTION CONTROL,
1655 OIL SPILLS, NORTH SEA, ENVIRONMENTAL PROTECTION, OIL TRANSFER, TANKERS, SURVEILLANCE,
1657 OIL SPILLS, OCEANS, COASTS, ALASKA, STATISTICS,
1661 OIL SPILLS, TANKERS, *LIBERIAN REGISTRY, *FLAGS OF CONVENIENCE,
1662 OIL SPILLS, OCEANS, TANKERS, STATISTICS, *TANKER ACCIDENTS,
1663 OIL SPILLS, EUROPE, OIL TRANSPORT, PIPELINES, SPILL CLEANUP, *CROSS COUNTRY PIPELINES
1664 OIL SPILLS, MONITORING, FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, SPILL CLEANUP, *1977 OIL SPILL CONFERENCE,
1670 OIL SPILLS, MONITORING, CHEMICAL ANALYSIS, WASTE OIL, *IR ABSORPTION ,
1674 OIL SPILLS, MONITORING, DETECTION, DESIGN-ENGINEERING, *BUOYS, *GAS SENSORS,
1692 OIL SPILLS, MONITORING, ENVIRONMENTAL EFFECTS, CONTAMINANTS, REMOTE SENSING,
1723 OIL SPILLS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
1728 OIL SPILLS, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION,
1731 OIL SPILLS, OIL DISCHARGES, OFFSHORE DEVELOPMENT, NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS, SOURCE IDENTIFICATION, TANKERS,
1792 OIL SPILLS, RESTORATION, WILDLIFE, SURFACTANTS, SOLVENTS, TOXICITY,
1794 OIL SPILLS, MOLLUSKS, ENGLAND, BIOLOGICAL EFFECTS, ALGAE, RESTORATION, SHORELINES, *ROCKY SHORES,
1797 OIL SPILLS, EIS, CRUDE OIL, ALASKA, OIL TRANSPORT, PIPELINES, TEXAS,
1883 OIL SPILLS, CONTINGENCY PLANNING, PERSONNEL TRAINING, POLLUTION CONTROL, *OIL SPILL CONTROL COURSE,
1889 OIL SPILLS, POLLUTION PREVENTION, TANKERS, OIL TANKS, *TIN CAN CONTAINERS,
1892 OIL SPILLS, POLLUTION CONTROL, USCG,
1899 OIL SPILLS, LEAKAGE, DETECTION, PRODUCTION , POLLUTION PREVENTION, PIPELINES,
1902 OIL SPILLS, OIL DISCHARGES, LIABILITY, INTERNATIONAL CONVENTIONS, TANKERS, SAFETY, POLLUTION CONTROL,
1905 OIL SPILLS, BEAUFORT SEA, ARCTIC, POLLUTION CONTROL, *SPILL COUNTERMEASURES,
1906 OIL SPILLS, OCEANS, INLAND, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, SPILL CLEANUP,
1908 OIL SPILLS, LEGISLATION, LAW ENFORCEMENT, POLLUTION PREVENTION, USCG,
1909 OIL SPILLS, OIL DISCHARGES, LEAKAGE, POLLUTION PREVENTION, SHIPS,
1910 OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, TOXICITY,
1917 OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS, RESTORATION,
1918 OIL SPILLS, OIL SLICKS, CHRONIC EFFECTS, BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS,
1927 OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS, BIOLOGICAL EFFECTS, SANTA BARBARA CHANNEL,
1937 OIL SPILLS, MOLLUSKS, MARSHES, MARINE ORGANISMS, CHESAPEAKE BAY, BIRDS, BIOLOGICAL EFFECTS, *MARSH GRASSES,
1944 OIL SPILLS, MASSACHUSETTS, MARSHES, FUEL OIL, CRUSTACEANS, CONTAMINATION, BIOLOGICAL EFFECTS, *UCA PUGNAX,
1952 OIL SPILLS, INVERTEBRATES, FUEL OIL, FISH, BIOLOGICAL EFFECTS, STREAMS, VIRGINIA,
1977 OIL SPILLS, MARINE ORGANISMS, INTERTIDAL ZONE, CHEDABUCTO BAY, CANADA, TOXICITY, *MORTALITIES,
1984 OIL SPILLS, MOLLUSKS, MAINE, BIOLOGICAL EFFECTS, *GONADAL NEOPLASMS, *MYA ARENARIA,
1988 OIL SPILLS, OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, TANKERS, *SPILL SUPERFUNDS,
1989 OIL SPILLS, LIABILITY, ALASKA, REGULATIONS, TANKERS, OIL TRANSFER, PORTS, *OIL SPILL FUND,
1991 OIL SPILLS, INLAND, ECONOMICS, CALIFORNIA, SPILL CLEANUP, RESTORATION,
1992 OIL SPILLS, LEGISLATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CANADA, TANKERS,
1994 OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS,
1995 OIL SPILLS, MALAYSIA, ENVIRONMENTAL EFFECTS, TANKERS,
1996 OIL SPILLS, MARINE ORGANISMS, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, DISPERSANTS, SHORELINES, TOXICITY,
1997 OIL SPILLS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, US, *WORLD WAR II,
1999 OIL SPILLS, MARSHES, ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, VEGETATION, SOIL,
2002 OIL SPILLS, OFFSHORE PRODUCTION, NORTH SEA, FISHERIES, BIRDS, REFINERIES, OIL TRANSPORT, POLLUTION CONTROL, TOXICITY,
2005 OIL SPILLS, MARINE ORGANISMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, CONTAMINATION, CHRONIC EFFECTS,
2016 OIL SPILLS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, SHORELINES,
2079 OIL SPILLS, BIODEGRADATION, PATENT, *NUTRIENT ADDITION,
2085 OIL SPILLS, HYDROCARBONS, FATE, EVAPORATION, SOLUTION, WEATHERING,
2086 OIL SPILLS, ICE, BEAUFORT SEA, SPREADING, *UNDER-ICE SPILL,
2087 OIL SPILLS, MODELS, EVAPORATION, DELAWARE BAY, WEATHERING, OIL TRANSFER,
2088 OIL SPILLS, MODELS, FATE, OXIDATION, *N-HEXADECANE, *PHOTOOXIDATION ,
2093 OIL SPILLS, NORWAY, FISH, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BIODEGRADATION, AROMATIC HYDROCARBONS , WEATHERING, *T/T "DRUPA" SPILL,
2094 OIL SPILLS, MODELS, INTERTIDAL ZONE, FATE, DISTRIBUTION, BIODEGRADATION, BALTIC SEA,
2095 OIL SPILLS, MOVEMENT, ALASKA, *COASTAL WINDS,

2096 OIL SPILLS, ICE, FATE, ALASKA, *OIL-UNDER-ICE , *IMPULSE RADAR SYSTEM,
2098 OIL SPILLS, MOVEMENT, BEAUFORT SEA, ALASKA COAST, SHORELINES, *SPILL IMPACT PROBABILITY,
2099 OIL SPILLS, FATE, DISPERSANTS, BIOLOGICAL EFFECTS,
2108 OIL SPILLS, LIABILITY, LEGISLATION, COMPENSATION, US, SPILL CLEANUP, *COSTS,
2110 OIL SPILLS, LEGISLATION, US, STATE GOVERNMENTS, TANKERS, POLLUTION CONTROL,
2119 OIL SPILLS, LEGISLATION, LAW ENFORCEMENT, ENGLAND, CANADA, SHIPS,
2128 OIL SPILLS, MICROORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, ANIMALS, PLANTS,
1745 OIL TANKS, CLEANUP, SWEDEN, *TANK CLEANING STATION,
1765 OIL TANKS, CONTAMINATION, ABSORPTION, PATENT, *CLEANUP ,
1798 OIL TANKS, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *SALT DOMES, *STRATEGIC PETROLEUM RESERVE,
1889 OIL TANKS, OIL SPILLS, POLLUTION PREVENTION, TANKERS, *TIN CAN CONTAINERS,
1639 OIL TRANSFER, OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, REGULATIONS, SCOTLAND,
1655 OIL TRANSFER, OIL SPILLS, NORTH SEA, ENVIRONMENTAL PROTECTION, TANKERS, SURVEILLANCE,
1989 OIL TRANSFER, OIL SPILLS, LIABILITY, ALASKA, REGULATIONS, TANKERS, PORTS, *OIL SPILL FUND,
2087 OIL TRANSFER, OIL SPILLS, MODELS, EVAPORATION, DELAWARE BAY, WEATHERING,
2124 OIL TRANSFER, OFFSHORE DRILLING, NORTH SEA, LIABILITY, INTERNATIONAL AGREEMENTS, STORAGE,
1663 OIL TRANSPORT, OIL SPILLS, EUROPE, PIPELINES, SPILL CLEANUP, *CROSS COUNTRY PIPELINES ,
1679 OIL TRANSPORT, MONITORING, HYDROCARBONS, ENVIRONMENTAL EFFECTS, PIPELINES, REFINERIES, PUGET SOUND,
1742 OIL TRANSPORT, DESIGN-ENGINEERING, SPILL RECOVERY, *DRACONE BARGE,
1797 OIL TRANSPORT, OIL SPILLS, EIS, CRUDE OIL, ALASKA, PIPELINES, TEXAS,
1801 OIL TRANSPORT, TANKERS, SAFETY, *STANDARDS, *ACCIDENT PREVENTION,
1802 OIL TRANSPORT, GROUNDWATER, ADSORPTION, *LIME, *CLAY, *SOIL COMPONENTS,
1896 OIL TRANSPORT, TANKERS, PIPELINES, POLLUTION PREVENTION, SPILL RECOVERY,
1999 OIL TRANSPORT, OIL SPILLS, MARSHES, ENVIRONMENTAL EFFECTS, ALASKA, VEGETATION, SOIL,
2002 OIL TRANSPORT, OIL SPILLS, OFFSHORE PRODUCTION, NORTH SEA, FISHERIES, BIRDS, REFINERIES, POLLUTION CONTROL, TOXICITY,
2017 OIL TRANSPORT, FRESHWATER, EPA, ENVIRONMENTAL EFFECTS, ARCTIC, PIPELINES,
2111 OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, US, REGULATIONS, POLLUTION CONTROL,
2112 OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, SEGREGATED BALLAST , REGULATIONS, US, POLLUTION CONTROL,
1636 OIL-WATER SEPARATION, OIL DISCHARGES, DISTILLATION, POLLUTION CONTROL, USSR,
1675 OIL-WATER SEPARATION, MONITORING, POLLUTION CONTROL, SHIPS, *ULTRASONIC MONITOR,
1701 OIL-WATER SEPARATION, DETECTION, ANALYTICAL TECHNIQUES, PATENT, *OIL-IN-WATER, *FLUORESCENCE,
1772 OIL-WATER SEPARATION, DISPERSIONS, DESIGN-ENGINEERING, SPILL CLEANUP, PATENT,
1784 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, SEAWATER, PETROLEUM PRODUCTS,
1805 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1806 OIL-WATER SEPARATION, EMULSIONS, PATENT, *AMINE ADDITION,
1808 OIL-WATER SEPARATION, INDUSTRIES, FILTRATION, EMULSIONS, WASTEWATER TREATMENT, *ULTRAFILTRATION ,
1810 OIL-WATER SEPARATION, FILTRATION, WASTEWATER TREATMENT, PATENT,
1811 OIL-WATER SEPARATION, FILTRATION, EMULSIONS, PATENT, *ULTRAFILTRATION ,
1813 OIL-WATER SEPARATION, FILTRATION, WASTEWATER TREATMENT, REFINERIES, PENNSYLVANIA, *SAND FILTERS,
1815 OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, COALESCENCE, SHIPS, PATENT,
1823 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, PATENT,
1824 OIL-WATER SEPARATION, EMULSIONS, CRUDE OIL, PATENT,
1825 OIL-WATER SEPARATION, WASTEWATER TREATMENT, WASTE OIL, POLLUTION PREVENTION, REFINERIES,
1826 OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, PATENT, *CELLULOSE PULP,
1827 OIL-WATER SEPARATION, GASOLINE, DESIGN-ENGINEERING, SLUDGE, WASTEWATERS, PATENT,
1828 OIL-WATER SEPARATION, COAGULATION, PATENT, *PLASTICS POWDER,
1829 OIL-WATER SEPARATION, WASTE OIL TREATMENT, SURFACTANTS, PATENT,
1830 OIL-WATER SEPARATION, INDUSTRIES, CANADA, WASTEWATER TREATMENT, RECLAMATION, REUSE,
1831 OIL-WATER SEPARATION, EMULSIONS, CRUDE OIL, PATENT,
1832 OIL-WATER SEPARATION, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, OXIDATION, PATENT,
1833 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *POPCORN POLYMER,
1834 OIL-WATER SEPARATION, FILTRATION, CANADA, WASTEWATER TREATMENT, REFINERIES, *DUAL-MEDIA FILTERS,
1838 OIL-WATER SEPARATION, COALESCENCE, PATENT, *ULTRASONICS,
1839 OIL-WATER SEPARATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT,
1841 OIL-WATER SEPARATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, *GRAVITY SEPARATION ,
1843 OIL-WATER SEPARATION, WASTEWATER TREATMENT, REFINERIES, *PARALLEL PLATE SEPARATORS,
1845 OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, SKIMMERS, PATENT,
1848 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, PATENT,
1849 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, PATENT,
1852 OIL-WATER SEPARATION, EMULSIONS, CRUDE OIL,
1853 OIL-WATER SEPARATION, ABSORPTION, WASTEWATER TREATMENT, SPILL RECOVERY, PATENT, *SORBENT MATERIAL,

1854 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, PATENT, *CATIONIC POLYMERS,
1858 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, PATENT, *SOLVENT RECOVERY ,
1859 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, PATENT, *SOLVENT RECOVERY ,
1862 OIL-WATER SEPARATION, COALESCENCE, WASTEWATER TREATMENT, WASTEWATERS,
1864 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT,
1867 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SURFACTANTS, PATENT,
1869 OIL-WATER SEPARATION, FILTRATION, EMULSIONS, WASTEWATER TREATMENT, PATENT, *ULTRAFILTRATION ,
1871 OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT,
1875 OIL-WATER SEPARATION, FUELS, CRUDE OIL, SPILL RECOVERY, WASTEWATER TREATMENT,
1877 OIL-WATER SEPARATION, LUBRICATING OIL, FUELS, FILTRATION, WASTE OIL, RECLAMATION, *USCG POWER PLANTS,
1644 OIL WELLS, LOUISIANA, BLOWOUTS, *GAS-WELLS,
1729 OIL WELLS, GROUNDWATER, CONTAMINATION, SOURCE IDENTIFICATION, PRODUCTION , WASTEWATERS, *BRINE DISPOSAL,
2035 OIL WELLS, GROUNDWATER, DRILLING , CONTAMINATION, *DRILLING FLUIDS, *WELL COMPLETION,
1660 OLYMPIC GAMES SPILL, DELAWARE, BIRDS, TANKERS, SPILL CLEANUP, *DELAWARE RIVER,
2052 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, COASTS, POLLUTION PREVENTION,
1699 OREGON, MOLLUSKS, ESTUARIES, DETECTION, CARCINOGENS, SAMPLING, PAH, *BIVALVES,
1682 OXIDATION, MONITORING, PETROLEUM PRODUCTS, SEAWATER, *CHEMILUMINESCENCE,
1771 OXIDATION, BIODEGRADATION, ABSORPTION, SPILL CLEANUP, PETROLEUM PRODUCTS, SOIL, SOURCES,
1832 OXIDATION, OIL-WATER SEPARATION, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, PATENT,
1865 OXIDATION, OIL INDUSTRY, WASTEWATER TREATMENT,
2067 OXIDATION, CRUDE OIL, BIODEGRADATION, UPTAKE, *TEMPERATURE EFFECTS,
2080 OXIDATION, FUEL OIL, CASPIAN SEA, BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS,
2088 OXIDATION, OIL SPILLS, MODELS, FATE, *N-HEXADECANE, *PHOTOOXIDATION ,
2089 OXIDATION, FUEL OIL, TOXICITY, YEASTS, *UV IRRADIATION,
2105 OXIDATION, FATE, EVAPORATION, DISPERSIONS, CONTAMINATION, SEAWATER, SPREADING, SOLUTION,
1699 PAH, OREGON, MOLLUSKS, ESTUARIES, DETECTION, CARCINOGENS, SAMPLING, *BIVALVES,
1680 PATENT, OIL DISCHARGES, MONITORING, DESIGN-ENGINEERING, TANKERS, REGULATIONS,
1683 PATENT, MONITORING, DISPERSIONS, DETECTION, *OIL SOLUBLE DYE,
1701 PATENT, OIL-WATER SEPARATION, DETECTION, ANALYTICAL TECHNIQUES, *OIL-IN-WATER, *FLUORESCENCE,
1736 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, *CONNECTOR HINGE,
1737 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, SKIMMERS,
1740 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
1762 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY,
1763 PATENT, CONTAMINANTS, ABSORPTION, *OIL-ABSORBENT COMPOUND,
1765 PATENT, OIL TANKS, CONTAMINATION, ABSORPTION, *CLEANUP ,
1766 PATENT, LEAKAGE, TANKERS, SPILL CLEANUP, *OIL SOLIDIFICATION,
1772 PATENT, OIL-WATER SEPARATION, DISPERSIONS, DESIGN-ENGINEERING, SPILL CLEANUP,
1773 PATENT, DISPERSANTS, SPILL CLEANUP, *MAGNETIC POWDER,
1774 PATENT, BOOMS, SPILL RECOVERY,
1775 PATENT, INCINERATION, ABSORPTION, SPILL RECOVERY, *ABSORBENT FIBERS,
1777 PATENT, FUEL OIL, ADSORPTION, SPILL RECOVERY, *SAWDUST,
1779 PATENT, OIL SLICKS, DISPERSANTS, DESIGN-ENGINEERING, SPILL CLEANUP,
1780 PATENT, FLOCCULATION, SPILL RECOVERY, SEAWATER, RIVERS, SOLVENTS, COAGULATION,
1782 PATENT, OIL SLICKS, ABSORPTION, SPILL RECOVERY,
1783 PATENT, DISPERSANTS, BEACHES, SPILL RECOVERY, SURFACTANTS,
1785 PATENT, OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY,
1786 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL RECOVERY, SKIMMERS,
1787 PATENT, GASOLINE, FUEL OIL, ADSORPTION, SPILL CLEANUP,
1788 PATENT, OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, SHIPS,
1796 PATENT, DESIGN-ENGINEERING, STORAGE, TANKERS, *OIL STORAGE TANK,
1803 PATENT, INCINERATION, EVAPORATION, WASTEWATER TREATMENT, REFINERIES, *THERMAL OXIDATION ,
1806 PATENT, OIL-WATER SEPARATION, EMULSIONS, *AMINE ADDITION,
1809 PATENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, *COLLECTION RESERVOIR,
1810 PATENT, OIL-WATER SEPARATION, FILTRATION, WASTEWATER TREATMENT,
1811 PATENT, OIL-WATER SEPARATION, FILTRATION, EMULSIONS, *ULTRAFILTRATION ,
1815 PATENT, OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, COALESCENCE, SHIPS,
1821 PATENT, BIODEGRADATION, WASTEWATERS, SPILL CLEANUP, *H2O2,
1823 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, PETROLEUM PRODUCTS,
1824 PATENT, OIL-WATER SEPARATION, EMULSIONS, CRUDE OIL,
1826 PATENT, OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, *CELLULOSE PULP,
1827 PATENT, OIL-WATER SEPARATION, GASOLINE, DESIGN-ENGINEERING, SLUDGE, WASTEWATERS,
1828 PATENT, OIL-WATER SEPARATION, COAGULATION, *PLASTICS POWDER,
1829 PATENT, OIL-WATER SEPARATION, WASTE OIL TREATMENT, SURFACTANTS,
1831 PATENT, OIL-WATER SEPARATION, EMULSIONS, CRUDE OIL,

1832 PATENT, OXIDATION, OIL-WATER SEPARATION, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT,
1833 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *POPCORN POLYMER,
1835 PATENT, FLOTATION, WASTEWATER TREATMENT, *TETRAETHYLEAD REMOVAL,
1836 PATENT, OIL-WATER SEPARATION, COALESCENCE, *ULTRASONICS,
1845 PATENT, OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, SKIMMERS,
1848 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT,
1849 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT,
1850 PATENT, FLOTATION, EMULSIFIERS, ADSORPTION, WASTEWATER TREATMENT, SLUDGE,
1851 PATENT, WASTEWATER TREATMENT, COAGULATION,
1853 PATENT, OIL-WATER SEPARATION, ABSORPTION, WASTEWATER TREATMENT, SPILL RECOVERY, *SORBENT MATERIAL,
1854 PATENT, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, *CATIONIC POLYMERS,
1858 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, *SOLVENT RECOVERY ,
1859 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SOLVENTS, *SOLVENT RECOVERY ,
1866 PATENT, ABSORPTION, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, *ABSORBENT POLYOLEFIN,
1867 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, SURFACTANTS,
1869 PATENT, OIL-WATER SEPARATION, FILTRATION, EMULSIONS, WASTEWATER TREATMENT, *ULTRAFILTRATION ,
1893 PATENT, DRILLING , DESIGN-ENGINEERING, BLOWOUT PREVENTION,
1894 PATENT, LEAKAGE, DETECTION, PIPELINES,
1895 PATENT, LEAKAGE, DESIGN-ENGINEERING, PIPELINES, POLLUTION PREVENTION,
1901 PATENT, LEAKAGE, DETECTION, DESIGN-ENGINEERING, PIPELINES,
2059 PATENT, CRUDE OIL, BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, *NUTRIENT ADDITION,
2079 PATENT, OIL SPILLS, BIODEGRADATION, *NUTRIENT ADDITION,
1813 PENNSYLVANIA, OIL-WATER SEPARATION, FILTRATION, WASTEWATER TREATMENT, REFINERIES, *SAND FILTERS,
1862 PERSONNEL TRAINING, SPILL CLEANUP, POLLUTION CONTROL, TEXAS, *OIL SPILL CONTROL COURSE,
1863 PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING, POLLUTION CONTROL, *OIL SPILL CONTROL COURSE,
1884 PERSONNEL TRAINING, BLOWOUT PREVENTION, *BLOWOUT SCHOOL,
1887 PERSONNEL TRAINING, EUROPE, CONTINGENCY PLANNING, SPILL CLEANUP, UK, US,
1817 PETROCHEMICALS, HYDROCARBONS, WASTEWATER TREATMENT, REFINERIES, *SOLVENT EXTRACTION ,
1837 PETROCHEMICALS, OIL INDUSTRY, GERMANY, EAST, REFINERIES, WASTEWATER TREATMENT,
1842 PETROCHEMICALS, REFINERIES, WASTEWATER TREATMENT, *BIOLOGICAL DETOXICATION,
1903 PETROCHEMICALS, REFINERIES, POLLUTION CONTROL, WASTEWATERS, WATER QUALITY, RIVERS, USSR,
2026 PETROCHEMICALS, NORWAY, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, POLLUTION CONTROL,
2050 PETROCHEMICALS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, REFINERIES,
1662 PETROLEUM PRODUCTS, OXIDATION, MONITORING, SEAWATER, *CHEMILUMINESCENCE,
1690 PETROLEUM PRODUCTS, DETECTION, CHEMICAL ANALYSIS, REMOTE SENSING, SPECTROSCOPY, *COMPUTERIZED RAMAN SPECTROSCOPY ,
1693 PETROLEUM PRODUCTS, DETECTION, CRUDE OIL, REMOTE SENSING, *SEA SURFACE, *RADAR,
1702 PETROLEUM PRODUCTS, OCEANS, CONTAMINATION, *LASER RADAR, *SEA SURFACE,
1703 PETROLEUM PRODUCTS, OIL SLICKS, CHEMICAL ANALYSIS, SEAWATER, *SORBENTS,
1712 PETROLEUM PRODUCTS, FISH, CONTAMINATION, CHEMICAL ANALYSIS, SOURCES, GREAT LAKES,
1716 PETROLEUM PRODUCTS, ANALYTICAL TECHNIQUES, SEAWATER, *GRAVIMETRIC ANALYSIS, *SPECTROPHOTOMETRY,
1721 PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, SOIL,
1726 PETROLEUM PRODUCTS, HYDROCARBONS, CHEMICAL ANALYSIS, ADSORPTION, SEAWATER, SURFACTANTS, *ELECTROANALYSIS ,
1727 PETROLEUM PRODUCTS, FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SPECTROSCOPY,
1771 PETROLEUM PRODUCTS, OXIDATION, BIODEGRADATION, ABSORPTION, SPILL CLEANUP, SOIL, SOURCES,
1784 PETROLEUM PRODUCTS, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, SEAWATER,
1823 PETROLEUM PRODUCTS, PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT,
1866 PETROLEUM PRODUCTS, PATENT, ABSORPTION, WASTEWATER TREATMENT, *ABSORBENT POLYOLEFIN,
1868 PETROLEUM PRODUCTS, WASTEWATER TREATMENT, *COAGULATION,
1870 PETROLEUM PRODUCTS, FLOCCULATION, WASTEWATER TREATMENT,
1881 PETROLEUM PRODUCTS, WASTE OIL, RECLAMATION, REUSE,
1942 PETROLEUM PRODUCTS, METABOLISM, FISH, TOXICITY, *SPICARA SMARIS, *SOLEA LASCARIS NASUTA,
1943 PETROLEUM PRODUCTS, FISH, TOXICITY, *HEMATOLOGICAL CHANGES,
1955 PETROLEUM PRODUCTS, GASOLINE, FRESHWATER, CRUDE OIL, BIODEGRADATION, BACTERIA, ALGAE, TOXICITY, *PHOTOSYNTHESIS,
1964 PETROLEUM PRODUCTS, MARINE ORGANISMS, CRUDE OIL, TOXICITY, *COMPARATIVE TOXICITY , *BIOASSAY,
1969 PETROLEUM PRODUCTS, FUELS, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, *GROWTH, *REPRODUCTION, *FUCUS EDENTATUS DE LA PYL,
1981 PETROLEUM PRODUCTS, MOLLUSKS, UPTAKE, SEAWATER, *WATER PURIFICATION, *MYTILUS EDULIS,
2006 PETROLEUM PRODUCTS, MOVEMENT, LUBRICATING OIL, BIOLOGICAL EFFECTS, BACTERIA, SOIL,
2059 PETROLEUM PRODUCTS, PATENT, CRUDE OIL, BIODEGRADATION, BACTERIA, *NUTRIENT ADDITION,

2080 PETROLEUM PRODUCTS, OXIDATION, FUEL OIL, CASPIAN SEA, BIODEGRADATION, BACTERIA,
2092 PETROLEUM PRODUCTS, FATE, BIODEGRADATION, SURFACTANTS, SEAWATER, SEDIMENTS,
*SELF-PURIFICATION, *SEA OF AZOV,
2106 PETROLEUM PRODUCTS, MOVEMENT, JAPAN, SEDIMENTS, *SETO INLAND SEA,
1985 PHYSICAL EFFECTS, OIL SLICKS, *DETERGENTS, SEAWATER, *SEA SPRAY FORMATION,
2084 PHYSICAL EFFECTS, EMULSIONS, CRUDE OIL, *SUSPENDED SOLIDS, *STABILITY,
2104 PHYSICAL EFFECTS, OIL SLICKS, MODELS, BEHAVIOR, *WIND-CURRENT EFFECTS,
1939 PHYTOPLANKTON, CONTAMINATION, CHRONIC EFFECTS, AEGEAN SEA,
1948 PHYTOPLANKTON, ESTUARIES, CRUDE OIL, TOXICITY, *KUWAIT CRUDE,
1958 PHYTOPLANKTON, METABOLISM, HYDROCARBONS, BIOLOGICAL EFFECTS, *PLANT GROWTH,
*PHOTOSYNTHESIS,
1967 PHYTOPLANKTON, OIL DISCHARGES, OCS, HYDROCARBONS, CONTAMINATION, ATLANTIC COAST,
1980 PHYTOPLANKTON, FRESHWATER, CRUDE OIL, ARCTIC, TOXICITY, *PRIMARY PRODUCTION,
2010 PHYTOPLANKTON, OIL SLICKS, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, *LIGHT
REDUCTION, *PHOTOSYNTHESIS,
1651 PIPELINES, OIL SPILLS, CRUDE OIL, ALASKA, *PUMP STATION ACCIDENT,
1653 PIPELINES, OIL SPILLS, CRUDE OIL, ALASKA, *PUMP STATION ACCIDENT,
1663 PIPELINES, OIL TRANSPORT, OIL SPILLS, EUROPE, SPILL CLEANUP, *CROSS COUNTRY PIPELINES ,
1679 PIPELINES, OIL TRANSPORT, MONITORING, HYDROCARBONS, ENVIRONMENTAL EFFECTS, REFINERIES,
PUGET SOUND,
1686 PIPELINES, MONITORING, LEAKAGE, DETECTION,
1797 PIPELINES, OIL TRANSPORT, OIL SPILLS, EIS, CRUDE OIL, ALASKA, TEXAS,
1894 PIPELINES, PATENT, LEAKAGE, DETECTION,
1895 PIPELINES, PATENT, LEAKAGE, DESIGN-ENGINEERING, POLLUTION PREVENTION,
1896 PIPELINES, OIL TRANSPORT, TANKERS, POLLUTION PREVENTION, SPILL RECOVERY,
1899 PIPELINES, OIL SPILLS, LEAKAGE, DETECTION, PRODUCTION , POLLUTION PREVENTION,
1901 PIPELINES, PATENT, LEAKAGE, DETECTION, DESIGN-ENGINEERING,
2017 PIPELINES, OIL TRANSPORT, FRESHWATER, EPA, ENVIRONMENTAL EFFECTS, ARCTIC,
1935 PLANKTON , HYDROCARBONS, CRUSTACEANS, UPTAKE, RELEASE, *14C-1-NAPHTHALENE, *COPEPODS,
1940 PLANKTON , OCS, NEW YORK, CRUDE OIL, BENTHOS, TOXICITY, *NEW YORK BIGHT,
2014 PLANKTON , OFFSHORE DEVELOPMENT, OCS, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE
STUDIES, ALASKA,
1930 PLANTS, CRUDE OIL, CONTAMINATION, TOXICITY, *OLNEY BULRUSH, *MARSHHAY CORDGRASS,
2128 PLANTS, OIL SPILLS, MICROORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, ANIMALS,
1671 PLATFORMS, MONITORING, MEXICO/GULF OF, HYDROCARBONS, SOURCES, *GAS VENTING, *BRINE
DISCHARGE,
2041 PLATFORMS, OFFSHORE DRILLING, MARINE ORGANISMS, CALIFORNIA/SOUTHERN, UPTAKE, SEDIMENTS,
1836 POLAND, WASTEWATER TREATMENT, SOLID WASTES, REFINERIES,
1872 POLAND, FILTRATION, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, *CELLULOSE,
*DIATOMACEOUS EARTH,
1636 POLLUTION CONTROL, OIL-WATER SEPARATION, OIL DISCHARGES, DISTILLATION, USSR,
1642 POLLUTION CONTROL, NORWAY, NORTH SEA, BLOWOUTS, *EMERGENCY VESSEL,
1649 POLLUTION CONTROL, OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, STATISTICS, *DATA BANK,
UK,
1654 POLLUTION CONTROL, OIL SPILLS, NORTH SEA, EKOFISK BLOWOUT, SPILL CLEANUP,
1656 POLLUTION CONTROL, FATE, COASTS, URQUIOLA SPILL, SPILL CLEANUP, SPAIN,
1665 POLLUTION CONTROL, NORTH SEA, EKOFISK BLOWOUT,
1669 POLLUTION CONTROL, MONITORING, DESIGN-ENGINEERING,
1675 POLLUTION CONTROL, OIL-WATER SEPARATION, MONITORING, SHIPS, *ULTRASONIC MONITOR,
1687 POLLUTION CONTROL, OIL SLICKS, NATURAL SEEPAGE, REMOTE SENSING, *LANDSAT,
1688 POLLUTION CONTROL, OIL SLICKS, MONITORING, REMOTE SENSING, *LANDSAT,
1749 POLLUTION CONTROL, SPILL CLEANUP, *OIL SPILL PUMPS,
1769 POLLUTION CONTROL, USCG, *EQUIPMENT, *FAST SURFACE DELIVERY SYSTEM,
1819 POLLUTION CONTROL, WASTEWATERS, REFINERIES, *RADIOTRACER APPLICATIONS,
1882 POLLUTION CONTROL, PERSONNEL TRAINING, SPILL CLEANUP, TEXAS, *OIL SPILL CONTROL COURSE,
1883 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING, *OIL SPILL
CONTROL COURSE,
1892 POLLUTION CONTROL, OIL SPILLS, USCG,
1897 POLLUTION CONTROL, BLOWOUT PREVENTION, *SLIP RINGS, *EQUIPMENT,
1900 POLLUTION CONTROL, ESTUARIES, *CONFERENCE,
1902 POLLUTION CONTROL, OIL SPILLS, OIL DISCHARGES, LIABILITY, INTERNATIONAL CONVENTIONS,
TANKERS, SAFETY,
1903 POLLUTION CONTROL, PETROCHEMICALS, REFINERIES, WASTEWATERS, WATER QUALITY, RIVERS,
USSR,
1905 POLLUTION CONTROL, OIL SPILLS, BEAUFORT SEA, ARCTIC, *SPILL COUNTERMEASURES,
1906 POLLUTION CONTROL, OIL SPILLS, OCEANS, INLAND, ENVIRONMENTAL EFFECTS, SPILL CLEANUP,
1907 POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP,
1961 POLLUTION CONTROL, COASTS, BIOLOGICAL EFFECTS, BENTHOS, *PELAGIC ORGANISMS,
1987 POLLUTION CONTROL, OIL INDUSTRY, COST ANALYSIS, API, REGULATIONS, WASTEWATER
TREATMENT, REFINERIES,
1990 POLLUTION CONTROL, OIL INDUSTRY, EPA, ECONOMIC EFFECTS, COST ANALYSIS, API,
REGULATIONS,
2000 POLLUTION CONTROL, OCEANS, MARINE ORGANISMS, DISPERSANTS, CONTAMINATION, BIOLOGICAL
EFFECTS, SOURCES,
2002 POLLUTION CONTROL, OIL TRANSPORT, OIL SPILLS, OFFSHORE PRODUCTION, NORTH SEA,

FISHERIES, BIRDS, REFINERIES, TOXICITY,
2008 POLLUTION CONTROL, OCEANS, HYDROCARBONS, HEALTH HAZARDS, CONTAMINATION, BIOLOGICAL
EFFECTS,
2021 POLLUTION CONTROL, OFFSHORE DRILLING, OCS, FOSSIL FUELS , ENVIRONMENTAL MANAGEMENT,
REGULATIONS,
2023 POLLUTION CONTROL, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, REFINING, *TECHNOLOGY
ASSESSMENT,
2026 POLLUTION CONTROL, PETROCHEMICALS, NORWAY, CHEMICAL ANALYSIS, WASTEWATER TREATMENT,
2110 POLLUTION CONTROL, OIL SPILLS, LEGISLATION, US, STATE GOVERNMENTS, TANKERS,
2111 POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, US, REGULATIONS,
2112 POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, SEGREGATED BALLAST ,
REGULATIONS, US,
2115 POLLUTION CONTROL, OCEANS, LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL
AGREEMENTS, UK, US,
2116 POLLUTION CONTROL, LEGISLATION, INTERNATIONAL CONVENTIONS,
2121 POLLUTION CONTROL, CONTAMINANTS, CANADA, REGULATIONS, WASTEWATERS, REFINERIES,
2125 POLLUTION CONTROL, MONITORING, MEDITERRANEAN SEA, INTERNATIONAL CONVENTIONS,
BIOLOGICAL EFFECTS, UN,
2131 POLLUTION CONTROL, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT ,
BIBLIOGRAPHIES,
2132 POLLUTION CONTROL, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT ,
BIBLIOGRAPHIES,
2134 POLLUTION CONTROL, LEGISLATION, BIBLIOGRAPHIES, US,
1641 POLLUTION PREVENTION, MOVEMENT, MONITORING, ARGO MERCHANT SPILL, TANKERS, USGS,
1825 POLLUTION PREVENTION, OIL-WATER SEPARATION, WASTEWATER TREATMENT, WASTE OIL,
REFINERIES,
1888 POLLUTION PREVENTION, OFFSHORE DRILLING, EMULSIONS, DESIGN-ENGINEERING, *DRILLING MUDS,
1889 POLLUTION PREVENTION, OIL TANKS, OIL SPILLS, TANKERS, *TIN CAN CONTAINERS,
1890 POLLUTION PREVENTION, LEAKAGE, SHIPS, *STERNGEAR SEAL SYSTEM,
1891 POLLUTION PREVENTION, OFFSHORE DRILLING, GREENLAND, ARCTIC, SAFETY, *ICEBERGS,
1895 POLLUTION PREVENTION, PIPELINES, PATENT, LEAKAGE, DESIGN-ENGINEERING,
1896 POLLUTION PREVENTION, PIPELINES, OIL TRANSPORT, TANKERS, SPILL RECOVERY,
1899 POLLUTION PREVENTION, PIPELINES, OIL SPILLS, LEAKAGE, DETECTION, PRODUCTION ,
1908 POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, LAW ENFORCEMENT, USCG,
1909 POLLUTION PREVENTION, OIL SPILLS, OIL DISCHARGES, LEAKAGE, SHIPS,
2018 POLLUTION PREVENTION, OIL INDUSTRY, COST ANALYSIS, REGULATIONS, US, WATER QUALITY,
2019 POLLUTION PREVENTION, OIL INDUSTRY, ECONOMIC EFFECTS, COST ANALYSIS, REGULATIONS,
2052 POLLUTION PREVENTION, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL
EFFECTS, COASTS,
2122 POLLUTION PREVENTION, MANUALS, GUIDELINES, CONTINGENCY PLANNING, TANKERS,
2123 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, EPA, SWEDEN, *BALTIC CONVENTION,
1921 POLYCHAETES, FUEL OIL, CRUDE OIL, TOXICITY, *REPRODUCTION,
1734 PORTS, SPILL CONTAINMENT, TANKERS, SWEDEN, *SPILL BUBBLE BARRIER,
1969 PORTS, OIL TRANSFER, OIL SPILLS, LIABILITY, ALASKA, REGULATIONS, TANKERS, *OIL SPILL
FUND,
2047 PORTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL DETERIORATION, ATLANTIC COAST,
2048 PORTS, OFFSHORE DEVELOPMENT, NEW JERSEY, FISHERIES, ENVIRONMENTAL EFFECTS, DELAWARE,
ATLANTIC COAST,
2120 PORTS, LAW ENFORCEMENT, GOVERNMENT AGENCIES, REGULATIONS, TANKERS, USCG, SAFETY,
1643 PRODUCTION , NORTH SEA, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT,
1729 PRODUCTION , OIL WELLS, GROUNDWATER, CONTAMINATION, SOURCE IDENTIFICATION,
WASTEWATERS, *BRINE DISPOSAL,
1899 PRODUCTION , POLLUTION PREVENTION, PIPELINES, OIL SPILLS, LEAKAGE, DETECTION,
1998 PRODUCTION , MARINE ORGANISMS, FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION,
BIOLOGICAL EFFECTS, SOURCES, SHIPS, SEABIRDS, SPILL CLEANUP,
2007 PRODUCTION , FUELS, ENVIRONMENTAL EFFECTS, CONTAMINANTS,
2040 PRODUCTION , OIL SHALE, FOSSIL FUELS , ENVIRONMENTAL EFFECTS, TAR SANDS,
1679 PUGET SOUND, PIPELINES, OIL TRANSPORT, MONITORING, HYDROCARBONS, ENVIRONMENTAL
EFFECTS, REFINERIES,
1898 PUGET SOUND, OIL INDUSTRY, CONTINGENCY PLANNING, SPILL CLEANUP, *OIL SPILL COOPERATIVE,
1747 RECLAMATION, DESIGN-ENGINEERING, SPILL RECOVERY,
1830 RECLAMATION, OIL-WATER SEPARATION, INDUSTRIES, CANADA, WASTEWATER TREATMENT, REUSE,
1847 RECLAMATION, FUELS, WASTEWATER DISPOSAL, WASTE OIL, *LAND DISPOSAL, *SPRAY IRRIGATION,
1874 RECLAMATION, LUBRICATING OIL, WASTE OILS, *IFP PROCESS,
1876 RECLAMATION, ECONOMICS, WASTE OIL, REUSE,
1877 RECLAMATION, OIL-WATER SEPARATION, LUBRICATING OIL, FUELS, FILTRATION, WASTE
OIL, *USCG POWER PLANTS,
1878 RECLAMATION, INDUSTRIES, INDIA, REFINERIES, WASTEWATERS, REUSE,
1879 RECLAMATION, WASTE OIL, *REVIEW,
1880 RECLAMATION, WASTE OIL, *REVIEW,
1881 RECLAMATION, PETROLEUM PRODUCTS, WASTE OIL, REUSE,
1873 RECYCLING, LUBRICATING OIL, FILTRATION, COALESCENCE, WASTE OIL,
1950 RED SEA, ISRAEL, CORAL REEFS, CONTAMINATION, BIOLOGICAL EFFECTS, *SUCCESSION,
*RECOLONIZATION,
1679 REFINERIES, PUGET SOUND, PIPELINES, OIL TRANSPORT, MONITORING, HYDROCARBONS,

ENVIRONMENTAL EFFECTS,
1681 REFINERIES, MONITORING, STREAMS, SEDIMENTS, WASTEWATERS, SAMPLING, *HEAVY METALS,
1706 REFINERIES, FOSSIL FUELS , ANALYTICAL TECHNIQUES, WASTEWATERS,
1793 REFINERIES, MARSHES, ENGLAND, CONTAMINATION, RESTORATION, VEGETATION, WASTEWATERS,
*SALT MARSH,
1803 REFINERIES, PATENT, INCINERATION, EVAPORATION, WASTEWATER TREATMENT, *THERMAL
OXIDATION ,
1812 REFINERIES, INCINERATION, WASTEWATER DISPOSAL, SLUDGE, *FLUID BEDS,
1813 REFINERIES, PENNSYLVANIA, OIL-WATER SEPARATION, FILTRATION, WASTEWATER TREATMENT,
*SAND FILTERS,
1816 REFINERIES, EXTRACTION, CONTAMINANTS, WASTEWATER TREATMENT, SOLVENTS,
1817 REFINERIES, PETROCHEMICALS, HYDROCARBONS, WASTEWATER TREATMENT, *SOLVENT EXTRACTION ,
1819 REFINERIES, POLLUTION CONTROL, WASTEWATERS, *RADIOTRACER APPLICATIONS,
1820 REFINERIES, BIODEGRADATION, ACTIVATED SLUDGE , WASTEWATER TREATMENT,
1822 REFINERIES, FILTRATION, WASTEWATER TREATMENT,
1825 REFINERIES, POLLUTION PREVENTION, OIL-WATER SEPARATION, WASTEWATER TREATMENT. WASTE
OIL,
1834 REFINERIES, OIL-WATER SEPARATION, FILTRATION, CANADA, WASTEWATER TREATMENT,
*DUAL-MEDIA FILTERS,
1836 REFINERIES, POLAND, WASTEWATER TREATMENT, SOLID WASTES,
1837 REFINERIES, PETROCHEMICALS, OIL INDUSTRY, GERMANY, EAST, WASTEWATER TREATMENT,
1842 REFINERIES, PETROCHEMICALS, WASTEWATER TREATMENT, *BIOLOGICAL DETOXICATION,
1843 REFINERIES, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *PARALLEL PLATE SEPARATORS,
1844 REFINERIES, OHIO, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, SOLID WASTES,
*UPFLOW SAND FILTERS,
1846 REFINERIES, EPA, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, *ANALYTICAL VARIABILITY,
1855 REFINERIES, INLAND, DISPOSAL , CONTAMINANTS, WASTEWATERS, SOLID WASTES, *WASTE
DISPOSAL PRACTICES, *LANDFILLS,
1856 REFINERIES, WASTEWATER TREATMENT, *REVERSE OSMOSIS, *WATER RECOVERY ,
1857 REFINERIES, FILTRATION, WASTEWATER TREATMENT, WATER QUALITY, *ONTARIO,
1860 REFINERIES, EMULSIONS, DESIGN-ENGINEERING, WASTE OIL TREATMENT,
1861 REFINERIES, ECONOMICS, CRUDE OIL, COST ANALYSIS, WASTEWATER TREATMENT, USSR,
1863 REFINERIES, DISPOSAL , WASTEWATER TREATMENT, *BIOLOGICAL TREATMENT, *UNDERGROUND WASTE
INJECTION,
1876 REFINERIES, RECLAMATION, INDUSTRIES, INDIA, WASTEWATERS, REUSE,
1905 REFINERIES, POLLUTION CONTROL, PETROCHEMICALS, WASTEWATERS, WATER QUALITY, RIVERS,
USSR,
1946 REFINERIES, MONITORING, INVERTEBRATES, FRESHWATER, TOXICITY, WASTEWATERS, *DAPHNIA
PULEX, *BIOASSAY,
1987 REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, COST ANALYSIS, API, REGULATIONS,
WASTEWATER TREATMENT,
2002 REFINERIES, POLLUTION CONTROL, OIL TRANSPORT, OIL SPILLS, OFFSHORE PRODUCTION, NORTH
EA, FISHERIES, BIRDS, TOXICITY,
2050 REFINERIES, PETROCHEMICALS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS,
2064 REFINERIES, DISPOSAL , BIODEGRADATION, SLUDGE, SOIL, WASTE OIL,
2109 REFINERIES, OFFSHORE DEVELOPMENT, OCS, LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS, US,
2117 REFINERIES, GUIDELINES, ENVIRONMENTAL PROTECTION, CANADA, WASTEWATER TREATMENT,
*ALBERTA,
2118 REFINERIES, ENVIRONMENTAL PROTECTION, ECONOMICS, CANADA, REGULATIONS, WASTEWATERS,
*QUEBEC,
2121 REFINERIES, POLLUTION CONTROL, CONTAMINANTS, CANADA, REGULATIONS, WASTEWATERS,
2023 REFINING, POLLUTION CONTROL, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, *TECHNOLOGY
ASSESSMENT,
1639 REGULATIONS, OIL TRANSFER, OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, SCOTLAND,
1680 REGULATIONS, PATENT, OIL DISCHARGES, MONITORING, DESIGN-ENGINEERING, TANKERS,
1987 REGULATIONS, REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, COST ANALYSIS, API,
WASTEWATER TREATMENT,
1989 REGULATIONS, PORTS, OIL TRANSFER, OIL SPILLS, LIABILITY, ALASKA, TANKERS, *OIL SPILL
FUND,
1990 REGULATIONS, POLLUTION CONTROL, OIL INDUSTRY, EPA, ECONOMIC EFFECTS, COST ANALYSIS,
API,
2018 REGULATIONS, POLLUTION PREVENTION, OIL INDUSTRY, COST ANALYSIS, US, WATER QUALITY,
2019 REGULATIONS, POLLUTION PREVENTION, OIL INDUSTRY, ECONOMIC EFFECTS, COST ANALYSIS,
2020 REGULATIONS, OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL PROTECTION, EKOFISK
BLOWOUT, SAFETY,
2021 REGULATIONS, POLLUTION CONTROL, OFFSHORE DRILLING, OCS, FOSSIL FUELS , ENVIRONMENTAL
MANAGEMENT,
2111 REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, US,
2112 REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS,
SEGREGATED BALLAST , US,
2113 REGULATIONS, ENVIRONMENTAL PROTECTION, TANKERS, SEGREGATED BALLAST , USCG,
2114 REGULATIONS, OIL DISCHARGES, TANKERS, WASTEWATERS, USCG,
2118 REGULATIONS, REFINERIES, ENVIRONMENTAL PROTECTION, ECONOMICS, CANADA, WASTEWATERS,
*QUEBEC,
2120 REGULATIONS, PORTS, LAW ENFORCEMENT, GOVERNMENT AGENCIES, TANKERS, USCG, SAFETY,

2121 REGULATIONS, REFINERIES, POLLUTION CONTROL, CONTAMINANTS, CANADA, WASTEWATERS,
1912 RELEASE, HYDROCARBONS, ANNELIDS, SEDIMENT, UPTAKE, *PHASCOLOSOMA AGASSIZII,
*NAPHTHALENES,
1929 RELEASE, MOLLUSKS, CRUDE OIL, UPTAKE, *NAPHTHALENES, *RANGEA CUNEATA, *PROTOTHACA
TAMINEA,
1933 RELEASE, HYDROCARBONS, FISH, UPTAKE, *COHO AND CHINOOK SALMON, *CHLORINATED BIPHENYLS,
*ENZYME ACTIVITY,
1935 RELEASE, PLANKTON , HYDROCARBONS, CRUSTACEANS, UPTAKE, *14C-1-NAPHTHALENE, *COPEPODS,
1947 RELEASE, MARINE ORGANISMS, HYDROCARBONS, UPTAKE, STORAGE,
1962 RELEASE, MARINE ORGANISMS, FUEL OIL, CRUDE OIL, TOXICITY, UPTAKE,
.968 RELEASE, MOLLUSKS, FUEL OIL, EMULSIONS, UPTAKE, *MYA ARENARIA L.,
1976 RELEASE, OCEANS, HYDROCARBONS, FOOD WEB, UPTAKE, *FOOD CHAIN TRANSFER,
1979 RELEASE, MOLLUSKS, TOXICITY, UPTAKE, *OIL DROPLETS, *MORTALITY, *CRASSOSTREA GIGAS,
*MYTILUS SPP.,
2102 RELEASE, OIL SLICKS, INTERTIDAL ZONE, HYDROCARBONS, ALASKA, UPTAKE, SEDIMENTS,
1687 REMOTE SENSING, POLLUTION CONTROL, OIL SLICKS, NATURAL SEEPAGE, *LANDSAT,
1688 REMOTE SENSING, POLLUTION CONTROL, OIL SLICKS, MONITORING, *LANDSAT,
1689 REMOTE SENSING, OIL SLICKS, OCEANS, SURVEILLANCE, *DYS/SLICK SEAMARKING DEVICE,
1690 REMOTE SENSING, PETROLEUM PRODUCTS, DETECTION, CHEMICAL ANALYSIS, SPECTROSCOPY,
*COMPUTERIZED RAMAN SPECTROSCOPY ,
1691 REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, MONITORING, DETECTION, COASTS, *LANDSAT
DATA,
1692 REMOTE SENSING, OIL SPILLS, MONITORING, ENVIRONMENTAL EFFECTS, CONTAMINANTS,
1693 REMOTE SENSING, PETROLEUM PRODUCTS, DETECTION, CRUDE OIL, *SEA SURFACE, *RADAR,
1694 REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, DETECTION, SURVEILLANCE, SANTA BARBARA
HANNEL, *COASTAL ZONE COLOR SCANNER,
1695 REMOTE SENSING, OIL SLICKS, MOVEMENT, COASTS, WASTEWATERS, *CURRENT CIRCULATION,
*SATELLITE-AIRCRAFT-DROGUE STUDIES,
1696 REMOTE SENSING, OIL SLICKS, OCEANS, *WAVE DAMPING, *OIL PROPERTIES,
1697 REMOTE SENSING, OIL SLICKS, OCEANS, BIBLIOGRAPHIES, *RADAR, *SEA SURFACE,
2135 REMOTE SENSING, MONITORING, DETECTION, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SAMPLING,
1792 RESTORATION, OIL SPILLS, WILDLIFE, SURFACTANTS, SOLVENTS, TOXICITY,
1793 RESTORATION, REFINERIES, MARSHES, ENGLAND, CONTAMINATION, VEGETATION, WASTEWATERS,
*SALT MARSH,
1794 RESTORATION, OIL SPILLS, MOLLUSKS, ENGLAND, BIOLOGICAL EFFECTS, ALGAE, SHORELINES,
ROCKY SHORES,
1917 RESTORATION, OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, *SEABIRDS,
1991 RESTORATION, OIL SPILLS, INLAND, ECONOMICS, CALIFORNIA, SPILL CLEANUP,
1830 REUSE, RECLAMATION, OIL-WATER SEPARATION, INDUSTRIES, CANADA, WASTEWATER TREATMENT,
1876 REUSE, RECLAMATION, ECONOMICS, WASTE OIL,
1876 REUSE, REFINERIES, RECLAMATION, INDUSTRIES, INDIA, WASTEWATERS,
1881 REUSE, RECLAMATION, PETROLEUM PRODUCTS, WASTE OIL,
1780 RIVERS, PATENT, FLOCCULATION, SPILL RECOVERY, SEAWATER, SOLVENTS, COAGULATION,
1903 RIVERS, REFINERIES, POLLUTION CONTROL, PETROCHEMICALS, WASTEWATERS, WATER QUALITY,
USSR,
1646 SAFETY, OIL SPILLS, ECONOMICS, TANKERS, *LIBERIAN REGISTRY,
1801 SAFETY, OIL TRANSPORT, TANKERS, *STANDARDS, *ACCIDENT PREVENTION,
1891 SAFETY, POLLUTION PREVENTION, OFFSHORE DRILLING, GREENLAND, ARCTIC, *ICEBERGS,
1902 SAFETY, POLLUTION CONTROL, OIL SPILLS, OIL DISCHARGES, LIABILITY, INTERNATIONAL
CONVENTIONS, TANKERS,
2020 SAFETY, REGULATIONS, OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL PROTECTION,
EKOFISK BLOWOUT,
2051 SAFETY, OFFSHORE DEVELOPMENT, OCS, LABRADOR SEA, ICE, *MINING TECHNOLOGY,
2120 SAFETY, REGULATIONS, PORTS, LAW ENFORCEMENT, GOVERNMENT AGENCIES, TANKERS, USCG,
1667 SAMPLING, MONITORING, CONTAMINANTS, ANALYTICAL TECHNIQUES,
1681 SAMPLING, REFINERIES, MONITORING, STREAMS, SEDIMENTS, WASTEWATERS, *HEAVY METALS,
1698 SAMPLING, OIL-GAS LEASING, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SEAWATER,
*SEASONAL VARIATIONS, *MAFLA LEASE AREA,
1699 SAMPLING, PAH, OREGON, MOLLUSKS, ESTUARIES, DETECTION, CARCINOGENS, *BIVALVES,
1700 SAMPLING, DISTRIBUTION, BERING SEA, ALASKA/GULF OF, TAR, *PLASTICS,
1713 SAMPLING, INTERTIDAL ZONE, HYDROCARBONS, ANALYTICAL TECHNIQUES, SEDIMENTS, WASHINGTON,
2090 SAMPLING, MOVEMENT, MONITORING, ENVIRONMENTAL EFFECTS, BEHAVIOR, ARGO MERCHANT SPILL,
2135 SAMPLING, REMOTE SENSING, MONITORING, DETECTION, CHEMICAL ANALYSIS, BIBLIOGRAPHIES,
1694 SANTA BARBARA CHANNEL, REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, DETECTION,
SURVEILLANCE, *COASTAL ZONE COLOR SCANNER,
1722 SANTA BARBARA CHANNEL, NATURAL SEEPAGE, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
CALIFORNIA/SOUTHERN, BIODEGRADATION, WEATHERING, SPECTROMETRY,
1927 SANTA BARBARA CHANNEL, OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS,
BIOLOGICAL EFFECTS,
1648 SARGASSO SEA, OCEANS, DISTRIBUTION, CANADA, ATLANTIC OCEAN, TAR,
1639 SCOTLAND, REGULATIONS, OIL TRANSFER, OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS,
2012 SCOTLAND, OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES,
1682 SEAWATER, PETROLEUM PRODUCTS, OXIDATION, MONITORING, *CHEMILUMINESCENCE,
1698 SEAWATER, SAMPLING, OIL-GAS LEASING, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS,
SEASONAL VARIATIONS, *MAFLA LEASE AREA,

1703 SEAWATER, PETROLEUM PRODUCTS, OIL SLICKS, CHEMICAL ANALYSIS, *SORBENTS,
1705 SEAWATER, HYDROCARBONS, FUEL OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *WATER-SOLUBLE FRACTION,
1707 SEAWATER, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , *ELECTROCHEMICAL ANALYSIS ,
1711 SEAWATER, HYDROCARBONS, CHROMATOGRAPHY, BEACHES, ANALYTICAL TECHNIQUES, ABSORPTION, SPECTROSCOPY,
1716 SEAWATER, PETROLEUM PRODUCTS, ANALYTICAL TECHNIQUES, *GRAVIMETRIC ANALYSIS, *SPECTROPHOTOMETRY,
1726 SEAWATER, PETROLEUM PRODUCTS, HYDROCARBONS, CHEMICAL ANALYSIS, ADSORPTION, SURFACTANTS, *ELECTROANALYSIS ,
1780 SEAWATER, RIVERS, PATENT, FLOCCULATION, SPILL RECOVERY, SOLVENTS, COAGULATION,
1784 SEAWATER, PETROLEUM PRODUCTS, OIL-WATER SEPARATION, FLOTATION, EMULSIONS,
1791 SEAWATER, MARSHES, FRESHWATER, DISPOSAL , DISPERSANTS, COASTS, BEACHES, ABSORPTION, SPILL CLEANUP,
1975 SEAWATER, MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, SEDIMENTS, *WATER-SOLUBLE FRACTION, *OIL-TREATED SEDIMENT, *MACOMA BALTHICA,
1981 SEAWATER, PETROLEUM PRODUCTS, MOLLUSKS, UPTAKE, *WATER PURIFICATION, *MYTILUS EDULIS,
1985 SEAWATER, PHYSICAL EFFECTS, OIL SLICKS, *DETERGENTS, *SEA SPRAY FORMATION,
2077 SEAWATER, ICE, HYDROCARBONS, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, SEDIMENTS,
2083 SEAWATER, DISTRIBUTION, *OIL PARTICLES,
2092 SEAWATER, PETROLEUM PRODUCTS, FATE, BIODEGRADATION, SURFACTANTS, SEDIMENTS, *SELF-PURIFICATION, *SEA OF AZOV,
2097 SEAWATER, HYDROCARBONS, FATE, BIODEGRADATION, ECOSYSTEM, SEDIMENTATION, *NAPHTHALENES,
2101 SEAWATER, MARINE ORGANISMS, HYDROCARBONS, FATE, *MOLECULAR INTERACTIONS,
2105 SEAWATER, OXIDATION, FATE, EVAPORATION, DISPERSIONS, CONTAMINATION, SPREADING, SOLUTION,
2097 SEDIMENTATION, SEAWATER, HYDROCARBONS, FATE, BIODEGRADATION, ECOSYSTEM, *NAPHTHALENES,
1678 SEDIMENTS, MONITORING, MEXICO/GULF OF, HYDROCARBONS, SOURCES, *CONTINENTAL SHELF,
1681 SEDIMENTS, SAMPLING, REFINERIES, MONITORING, STREAMS, WASTEWATERS, *HEAVY METALS,
1704 SEDIMENTS, OFFSHORE PRODUCTION, CHEMICAL ANALYSIS, VENEZUELA, STATISTICAL ANALYSIS,
1710 SEDIMENTS, HYDROCARBONS, CRUSTACEANS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, ZOOPLANKTON,
1713 SEDIMENTS, SAMPLING, INTERTIDAL ZONE, HYDROCARBONS, ANALYTICAL TECHNIQUES, WASHINGTON,
1717 SEDIMENTS, MONITORING, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , *GLASS CAPILLARY COLUMNS,
1725 SEDIMENTS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SPECTROSCOPY, *INTERCALIBRATION,
1730 SEDIMENTS, LAKES, HYDROCARBONS, SOURCE IDENTIFICATION,
1957 SEDIMENTS, MICROORGANISMS, INTERTIDAL ZONE, BIOMASS, BIOLOGICAL EFFECTS, BACTERIA,
1975 SEDIMENTS, SEAWATER, MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, *WATER-SOLUBLE FRACTION, *OIL-TREATED SEDIMENT, *MACOMA BALTHICA,
1993 SEDIMENTS, METULA SPILL, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, BEACHES,
2041 SEDIMENTS, PLATFORMS, OFFSHORE DRILLING, MARINE ORGANISMS, CALIFORNIA/SOUTHERN, UPTAKE,
2069 SEDIMENTS, HYDROCARBONS, FUNGI, FRESHWATER, BIODEGRADATION, BACTERIA,
2071 SEDIMENTS, MICROORGANISMS, LAKES, HYDROCARBONS, GASOLINE, BIODEGRADATION, ALASKA,
2077 SEDIMENTS, SEAWATER, ICE, HYDROCARBONS, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA,
2091 SEDIMENTS, MARINE ORGANISMS, HYDROCARBONS, FUEL OIL, ESTUARIES, VIRGINIA,
2092 SEDIMENTS, SEAWATER, PETROLEUM PRODUCTS, FATE, BIODEGRADATION, SURFACTANTS, *SELF-PURIFICATION, *SEA OF AZOV,
2102 SEDIMENTS, RELEASE, OIL SLICKS, INTERTIDAL ZONE, HYDROCARBONS, ALASKA, UPTAKE,
2106 SEDIMENTS, PETROLEUM PRODUCTS, MOVEMENT, JAPAN, *SETO INLAND SEA,
2112 SEGREGATED BALLAST , REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, TANKERS, US,
2113 SEGREGATED BALLAST , REGULATIONS, ENVIRONMENTAL PROTECTION, TANKERS, USCG,
1675 SHIPS, POLLUTION CONTROL, OIL-WATER SEPARATION, MONITORING, *ULTRASONIC MONITOR,
1664 SHIPS, MONITORING, DETECTION, DESIGN-ENGINEERING, BILGES,
1750 SHIPS, BOOMS, ABSORPTION, SPILL RECOVERY, SKIMMERS,
1788 SHIPS, PATENT, OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS,
1815 SHIPS, PATENT, OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, COALESCENCE,
1690 SHIPS, POLLUTION PREVENTION, LEAKAGE, *STERNGEAR SEAL SYSTEM,
1909 SHIPS, POLLUTION PREVENTION, OIL SPILLS, OIL DISCHARGES, LEAKAGE,
1998 SHIPS, PRODUCTION , MARINE ORGANISMS, FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, SEABIRDS, SPILL CLEANUP,
2119 SHIPS, OIL SPILLS, LEGISLATION, LAW ENFORCEMENT, ENGLAND, CANADA,
1794 SHORELINES, RESTORATION, OIL SPILLS, MOLLUSKS, ENGLAND, BIOLOGICAL EFFECTS, ALGAE, *ROCKY SHORES,
1996 SHORELINES, OIL SPILLS, MARINE ORGANISMS, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY,
2015 SHORELINES, OFFSHORE DEVELOPMENT, HABITAT, ENVIRONMENTAL EFFECTS, BIRDS, ARCTIC, ALASKA, *SHOREBIRD SPECIES,
2016 SHORELINES, OIL SPILLS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,
2098 SHORELINES, OIL SPILLS, MOVEMENT, BEAUFORT SEA, ALASKA COAST, *SPILL IMPACT PROBABILITY,
1770 SINKING AGENTS, DISPERSANTS, SPILL CLEANUP, TOXICITY,

1737 SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
1748 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY,
1750 SKIMMERS, SHIPS, BOOMS, ABSORPTION, SPILL RECOVERY,
1755 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY, *SKIMJET,
1756 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY,
1758 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY, *SEAWARD INTERNATIONAL,
1761 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY, *FAST CURRENT OIL RECOVERY ,
1775 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY,
1786 SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS, SPILL RECOVERY,
1788 SKIMMERS, SHIPS, PATENT, OIL SLICKS, DESIGN-ENGINEERING, SPILL RECOVERY,
1845 SKIMMERS, PATENT, OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING,
1812 SLUDGE, REFINERIES, INCINERATION, WASTEWATER DISPOSAL, *FLUID BEDS,
1827 SLUDGE, PATENT, OIL-WATER SEPARATION, GASOLINE, DESIGN-ENGINEERING, WASTEWATERS,
1850 SLUDGE, PATENT, FLOTATION, EMULSIFIERS, ADSORPTION, WASTEWATER TREATMENT,
2064 SLUDGE, REFINERIES, DISPOSAL , BIODEGRADATION, SOIL, WASTE OIL,
2022 SOCIO-ECONOMIC EFFECTS, OFFSHORE DRILLING, OCS, CRUDE OIL, ALASKA, *SEA GRANT PROGRAM, *ENERGY POLICY,
2033 SOCIO-ECONOMIC EFFECTS, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, EIS, ALASKA,
2055 SOCIO-ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, COASTS, US, STATE GOVERNMENTS,
1721 SOIL, PETROLEUM PRODUCTS, CHEMICAL ANALYSIS,
1771 SOIL, PETROLEUM PRODUCTS, OXIDATION, BIODEGRADATION, ABSORPTION, SPILL CLEANUP, SOURCES,
1999 SOIL, OIL TRANSPORT, OIL SPILLS, MARSHES, ENVIRONMENTAL EFFECTS, ALASKA, VEGETATION,
2006 SOIL, PETROLEUM PRODUCTS, MOVEMENT, LUBRICATING OIL, BIOLOGICAL EFFECTS, BACTERIA,
2064 SOIL, SLUDGE, REFINERIES, DISPOSAL , BIODEGRADATION, WASTE OIL,
2075 SOIL, MONITORING, FUNGI, BIODEGRADATION, BACTERIA, WASTE OIL, *ARID SITE,
2082 SOIL, HYDROCARBONS, CRUDE OIL, CANADA, BIODEGRADATION, BACTERIA, *NUTRIENT ADDITION,
2100 SOIL, HYDROCARBONS, CRUDE OIL, ADSORPTION, *DESORPTION, *ORGANIC MATTER CONTENT,
1836 SOLID WASTES, REFINERIES, POLAND, WASTEWATER TREATMENT,
1844 SOLID WASTES, REFINERIES, OHIO, FILTRATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, *UPFLOW SAND FILTERS,
1855 SOLID WASTES, REFINERIES, INLAND, DISPOSAL , CONTAMINANTS, WASTEWATERS, *WASTE DISPOSAL PRACTICES, *LANDFILLS,
1746 SOLUTION, EMULSIFIERS, DISPERSANTS, SPILL CLEANUP, TOXICITY,
2085 SOLUTION, OIL SPILLS, HYDROCARBONS, FATE, EVAPORATION, WEATHERING,
2105 SOLUTION, SEAWATER, OXIDATION, FATE, EVAPORATION, DISPERSIONS, CONTAMINATION, SPREADING,
1780 SOLVENTS, SEAWATER, RIVERS, PATENT, FLOCCULATION, SPILL RECOVERY, COAGULATION,
1792 SOLVENTS, RESTORATION, OIL SPILLS, WILDLIFE, SURFACTANTS, TOXICITY,
1816 SOLVENTS, REFINERIES, EXTRACTION, CONTAMINANTS, WASTEWATER TREATMENT,
1858 SOLVENTS, PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, *SOLVENT RECOVERY ,
1859 SOLVENTS, PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT, *SOLVENT RECOVERY ,
1677 SOURCE IDENTIFICATION, MONITORING, DESIGN-ENGINEERING, CHROMATOGRAPHY, *INSTRUMENT SURVEY,
1723 SOURCE IDENTIFICATION, OIL SPILLS, CHEMICAL ANALYSIS,
1727 SOURCE IDENTIFICATION, PETROLEUM PRODUCTS, FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES, SPECTROSCOPY,
1728 SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES,
1729 SOURCE IDENTIFICATION, PRODUCTION , OIL WELLS, GROUNDWATER, CONTAMINATION, WASTEWATERS, *BRINE DISPOSAL,
1730 SOURCE IDENTIFICATION, SEDIMENTS, LAKES, HYDROCARBONS,
1731 SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OFFSHORE DEVELOPMENT, NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS, TANKERS,
1637 SOURCES, OIL SPILLS, NORTH SEA, STATISTICS, UK,
1671 SOURCES, PLATFORMS, MONITORING, MEXICO/GULF OF, HYDROCARBONS, *GAS VENTING, *BRINE DISCHARGE,
1672 SOURCES, MONITORING, HYDROCARBONS, DISTRIBUTION, CHRONIC EFFECTS, AUSTRALIA, *MYTILUS EDULIS, *INDICATOR SPECIES,
1676 SOURCES, SEDIMENTS, MONITORING, MEXICO/GULF OF, HYDROCARBONS, *CONTINENTAL SHELF,
1712 SOURCES, PETROLEUM PRODUCTS, FISH, CONTAMINATION, CHEMICAL ANALYSIS, GREAT LAKES ,
1715 SOURCES, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROSCOPY, SPECTROMETRY,
1771 SOURCES, SOIL, PETROLEUM PRODUCTS, OXIDATION, BIODEGRADATION, ABSORPTION, SPILL CLEANUP,
1998 SOURCES, SHIPS, PRODUCTION , MARINE ORGANISMS, FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SEABIRDS, SPILL CLEANUP,
2000 SOURCES, POLLUTION CONTROL, OCEANS, MARINE ORGANISMS, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS,
2068 SOURCES, MICROORGANISMS, BIODEGRADATION, AROMATIC HYDROCARBONS ,
1656 SPAIN, POLLUTION CONTROL, FATE, COASTS, URQUIOLA SPILL, SPILL CLEANUP,
1710 SPECTROMETRY, SEDIMENTS, HYDROCARBONS, CRUSTACEANS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ZOOPLANKTON,

1715 SPECTROMETRY, SOURCES, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROSCOPY,

1722 SPECTROMETRY, SANTA BARBARA CHANNEL, NATURAL SEEPAGE, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, BIODEGRADATION, WEATHERING,

1690 SPECTROSCOPY, REMOTE SENSING, PETROLEUM PRODUCTS, DETECTION, CHEMICAL ANALYSIS, *COMPUTERIZED RAMAN SPECTROSCOPY ,

1708 SPECTROSCOPY, HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CANADA, ATLANTIC COAST,

1711 SPECTROSCOPY, SEAWATER, HYDROCARBONS, CHROMATOGRAPHY, BEACHES, ANALYTICAL TECHNIQUES, ABSORPTION,

1714 SPECTROSCOPY, MARINE ORGANISMS, HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BASELINE STUDIES,

1715 SPECTROSCOPY, SPECTROMETRY, SOURCES, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS,

1725 SPECTROSCOPY, SEDIMENTS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, *INTERCALIBRATION,

1727 SPECTROSCOPY, SOURCE IDENTIFICATION, PETROLEUM PRODUCTS, FUEL OIL, CRUDE OIL, ANALYTICAL TECHNIQUES,

1640 SPILL CLEANUP, LIABILITY, ARGO MERCHANT SPILL, TANKERS,

1650 SPILL CLEANUP, DISPERSANTS, UK, *OIL SPILL POLICY,

1654 SPILL CLEANUP, POLLUTION CONTROL, OIL SPILLS, NORTH SEA, EKOFISK BLOWOUT,

1656 SPILL CLEANUP, SPAIN, POLLUTION CONTROL, FATE, COASTS, URQUIOLA SPILL,

1659 SPILL CLEANUP, OIL INDUSTRY, NEW JERSEY, LEGISLATION, COMPENSATION, *SPILL FUND,

1660 SPILL CLEANUP, OLYMPIC GAMES SPILL, DELAWARE, BIRDS, TANKERS, *DELAWARE RIVER,

1663 SPILL CLEANUP, PIPELINES, OIL TRANSPORT, OIL SPILLS, EUROPE, *CROSS COUNTRY PIPELINES ,

1664 SPILL CLEANUP, OIL SPILLS, MONITORING, FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, *1977 OIL SPILL CONFERENCE,

1746 SPILL CLEANUP, SOLUTION, EMULSIFIERS, DISPERSANTS, TOXICITY,

1749 SPILL CLEANUP, POLLUTION CONTROL, *OIL SPILL PUMPS,

1752 SPILL CLEANUP, OIL SLICKS, DISPERSANTS, BOOMS, *PUMPS,

1753 SPILL CLEANUP, DESIGN-ENGINEERING, *OIL-SPILL PUMP,

1754 SPILL CLEANUP, CANADA, SPILL CONTAINMENT, *EQUIPMENT LOCATER SYSTEM,

1760 SPILL CLEANUP, ABSORPTION, SPILL CONTAINMENT, *POLYURETHANE FOAMS,

1764 SPILL CLEANUP, SPILL CONTAINMENT, *TREATMENT METHODS,

1766 SPILL CLEANUP, PATENT, LEAKAGE, TANKERS, *OIL SOLIDIFICATION,

1770 SPILL CLEANUP, SINKING AGENTS, DISPERSANTS, TOXICITY,

1771 SPILL CLEANUP, SOURCES, SOIL, PETROLEUM PRODUCTS, OXIDATION, BIODEGRADATION, ABSORPTION,

1772 SPILL CLEANUP, PATENT, OIL-WATER SEPARATION, DISPERSIONS, DESIGN-ENGINEERING,

1773 SPILL CLEANUP, PATENT, DISPERSANTS, *MAGNETIC POWDER,

1776 SPILL CLEANUP, OCEANS, ABSORPTION, *POLYURETHANE FOAMS,

1779 SPILL CLEANUP, PATENT, OIL SLICKS, DISPERSANTS, DESIGN-ENGINEERING,

1787 SPILL CLEANUP, PATENT, GASOLINE, FUEL OIL, ADSORPTION,

1790 SPILL CLEANUP, INCINERATION, ABSORPTION, *GELLING AGENTS,

1791 SPILL CLEANUP, SEAWATER, MARSHES, FRESHWATER, DISPOSAL , DISPERSANTS, COASTS, BEACHES, ABSORPTION,

1821 SPILL CLEANUP, PATENT, BIODEGRADATION, WASTEWATERS, *H2O2,

1882 SPILL CLEANUP, POLLUTION CONTROL, PERSONNEL TRAINING, TEXAS, *OIL SPILL CONTROL COURSE,

1886 SPILL CLEANUP, EPA, CONTINGENCY PLANNING, USCG,

1887 SPILL CLEANUP, PERSONNEL TRAINING, EUROPE, CONTINGENCY PLANNING, UK, US,

1896 SPILL CLEANUP, PUGET SOUND, OIL INDUSTRY, CONTINGENCY PLANNING, *OIL SPILL COOPERATIVE,

1906 SPILL CLEANUP, POLLUTION CONTROL, OIL SPILLS, OCEANS, INLAND, ENVIRONMENTAL EFFECTS,

1907 SPILL CLEANUP, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, DISPERSANTS,

1916 SPILL CLEANUP, OIL DISCHARGES, MARINE ORGANISMS, DISPERSANTS, TOXICITY,

1956 SPILL CLEANUP, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, BALTIC SEA,

1963 SPILL CLEANUP, FISH, DISPERSANTS, BIOLOGICAL EFFECTS, *EMBRYO DEVELOPMENT,

1991 SPILL CLEANUP, RESTORATION, OIL SPILLS, INLAND, ECONOMICS, CALIFORNIA,

1996 SPILL CLEANUP, SOURCES, SHIPS, PRODUCTION , MARINE ORGANISMS, FISHERIES, EXPLORATION , DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SEABIRDS,

2004 SPILL CLEANUP, DETECTION, CHEMICAL ANALYSIS,

2106 SPILL CLEANUP, OIL SPILLS, LIABILITY, LEGISLATION, COMPENSATION, US, *COSTS,

1732 SPILL CONTAINMENT, INLAND, HARBORS, BOOMS, *PRODUCT INFORMATION,

1733 SPILL CONTAINMENT, DESIGN-ENGINEERING, BOOMS, *OILFENCE,

1734 SPILL CONTAINMENT, PORTS, TANKERS, SWEDEN, *SPILL BUBBLE BARRIER,

1735 SPILL CONTAINMENT, DESIGN-ENGINEERING, BOOMS, *PRODUCT INFORMATION,

1736 SPILL CONTAINMENT, PATENT, DESIGN-ENGINEERING, BOOMS, *CONNECTOR HINGE,

1737 SPILL CONTAINMENT, SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS,

1738 SPILL CONTAINMENT, OIL SLICKS, BOOMS, BEHAVIOR, *SLICK DROPLET FORMATION, *ENTRAINMENT FAILURE,

1739 SPILL CONTAINMENT, OCEANS, FRESHWATER, DESIGN-ENGINEERING, BOOMS,

1740 SPILL CONTAINMENT, PATENT, DESIGN-ENGINEERING, BOOMS,

1741 SPILL CONTAINMENT, DESIGN-ENGINEERING, BOOMS, *SEABOOM,

1754 SPILL CONTAINMENT, SPILL CLEANUP, CANADA, *EQUIPMENT LOCATER SYSTEM,

1760 SPILL CONTAINMENT, SPILL CLEANUP, ABSORPTION, *POLYURETHANE FOAMS,

1764 SPILL CONTAINMENT, SPILL CLEANUP, *TREATMENT METHODS,

1742 SPILL RECOVERY, OIL TRANSPORT, DESIGN-ENGINEERING, *DRACONE BARGE,
1743 SPILL RECOVERY, DESIGN-ENGINEERING, ABSORPTION, USN, *FOAM CHIPS,
1744 SPILL RECOVERY, NORWAY, NORTH SEA, BOOMS, BLOWOUTS,
1747 SPILL RECOVERY, RECLAMATION, DESIGN-ENGINEERING,
1748 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1750 SPILL RECOVERY, SKIMMERS, SHIPS, BOOMS, ABSORPTION,
1751 SPILL RECOVERY, NORTH SEA, DESIGN-ENGINEERING, *OIL COLLECTION SYSTEMS,
1755 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *SKIMJET,
1756 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1757 SPILL RECOVERY, CONTINGENCY PLANNING, *RESPONSE TEAMS, US,
1758 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *SEAWARD INTERNATIONAL,
1761 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *FAST CURRENT OIL RECOVERY ,
1762 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING,
1767 SPILL RECOVERY, DESIGN-ENGINEERING, *LOCKHEED DISC-DRUM DEVICE, *PERFORMANCE,
1769 SPILL RECOVERY, COST ANALYSIS, ABSORPTION, *SORBENTS, *PERFORMANCE EVALUATION,
1774 SPILL RECOVERY, PATENT, BOOMS,
1775 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1776 SPILL RECOVERY, PATENT, INCINERATION, ABSORPTION, *ABSORBENT FIBERS,
1777 SPILL RECOVERY, PATENT, FUEL OIL, ADSORPTION, *SAWDUST,
1780 SPILL RECOVERY, SOLVENTS, SEAWATER, RIVERS, PATENT, FLOCCULATION, COAGULATION,
1781 SPILL RECOVERY, ABSORPTION, SURFACTANTS, *SORBENT WOOD CHIPS,
1782 SPILL RECOVERY, PATENT, OIL SLICKS, ABSORPTION,
1783 SPILL RECOVERY, PATENT, DISPERSANTS, BEACHES, SURFACTANTS,
1785 SPILL RECOVERY, PATENT, OIL SLICKS, DESIGN-ENGINEERING,
1786 SPILL RECOVERY, SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS,
1788 SPILL RECOVERY, SKIMMERS, SHIPS, PATENT, OIL SLICKS, DESIGN-ENGINEERING,
1853 SPILL RECOVERY, PATENT, OIL-WATER SEPARATION, ABSORPTION, WASTEWATER TREATMENT,
*SORBENT MATERIAL,
1875 SPILL RECOVERY, OIL-WATER SEPARATION, FUELS, CRUDE OIL, WASTEWATER TREATMENT,
1896 SPILL RECOVERY, POLLUTION PREVENTION, PIPELINES, OIL TRANSPORT, TANKERS,
2086 SPREADING, OIL SPILLS, ICE, BEAUFORT SEA, *UNDER-ICE SPILL,
2105 SPREADING, SOLUTION, SEAWATER, OXIDATION, FATE, EVAPORATION, DISPERSIONS,
CONTAMINATION,
2055 STATE GOVERNMENTS, SOCIO-ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL
EFFECTS, COASTS, US,
2110 STATE GOVERNMENTS, POLLUTION CONTROL, OIL SPILLS, LEGISLATION, US, TANKERS,
1704 STATISTICAL ANALYSIS, SEDIMENTS, OFFSHORE PRODUCTION, CHEMICAL ANALYSIS, VENEZUELA,
1904 STATISTICAL ANALYSIS, NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS, BLOWOUTS,
1637 STATISTICS, SOURCES, OIL SPILLS, NORTH SEA, UK,
1649 STATISTICS, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, *DATA BANK,
UK,
1657 STATISTICS, OIL SPILLS, OCEANS, COASTS, ALASKA,
1662 STATISTICS, OIL SPILLS, OCEANS, TANKERS, *TANKER ACCIDENTS,
1795 STORAGE, FEA, ENVIRONMENTAL PROTECTION, CRUDE OIL, TANKERS,
1796 STORAGE, PATENT, DESIGN-ENGINEERING, TANKERS, *OIL STORAGE TANK,
1798 STORAGE, OIL TANKS, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, *SALT DOMES, *STRATEGIC
PETROLEUM RESERVE,
1799 STORAGE, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, *SALT DOMES, *MINES, *STRATEGIC
PETROLEUM RESERVE,
1800 STORAGE, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, *BAYOU CHOCTAW SALT DOME,
1804 STORAGE, ECONOMICS, WASTE OIL DISPOSAL, UK,
1947 STORAGE, RELEASE, MARINE ORGANISMS, HYDROCARBONS, UPTAKE,
2124 STORAGE, OIL TRANSFER, OFFSHORE DRILLING, NORTH SEA, LIABILITY, INTERNATIONAL
AGREEMENTS,
1681 STREAMS, SEDIMENTS, SAMPLING, REFINERIES, MONITORING, WASTEWATERS, *HEAVY METALS,
1952 STREAMS, OIL SPILLS, INVERTEBRATES, FUEL OIL, FISH, BIOLOGICAL EFFECTS, VIRGINIA,
1951 SUBARCTIC REGIONS, MARINE ORGANISMS, HYDROCARBONS, ECOSYSTEMS, BIOLOGICAL EFFECTS,
ARCTIC,
2076 SUBARCTIC REGIONS, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, ARCTIC,
TOXICITY,
1709 SURFACTANTS, HYDROCARBONS, ENVIRONMENTAL PROTECTION, DETECTION, CONTAMINANTS, CHEMICAL
ANALYSIS,
1719 SURFACTANTS, DISPERSANTS, CHEMICAL ANALYSIS,
1726 SURFACTANTS, SEAWATER, PETROLEUM PRODUCTS, HYDROCARBONS, CHEMICAL ANALYSIS,
ADSORPTION, *ELECTROANALYSIS ,
1781 SURFACTANTS, SPILL RECOVERY, ABSORPTION, *SORBENT WOOD CHIPS,
1783 SURFACTANTS, SPILL RECOVERY, PATENT, DISPERSANTS, BEACHES,
1792 SURFACTANTS, SOLVENTS, RESTORATION, OIL SPILLS, WILDLIFE, TOXICITY,
1829 SURFACTANTS, PATENT, OIL-WATER SEPARATION, WASTE OIL TREATMENT,
1867 SURFACTANTS, PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATER TREATMENT,
1932 SURFACTANTS, FISH, DISPERSANTS, BIOLOGICAL EFFECTS, TOXICITY,
1965 SURFACTANTS, MOLLUSKS, HYDROCARBONS, EMULSIFIERS, CRUDE OIL, BIBLIOGRAPHIES, TOXICITY,
*MUSSELS,
1978 SURFACTANTS, EMULSIFIERS, ALGAE, TOXICITY, *SEAWEED, *GROWTH RATES,
2092 SURFACTANTS, SEDIMENTS, SEAWATER, PETROLEUM PRODUCTS, FATE, BIODEGRADATION,

*SELF-PURIFICATION, *SEA OF AZOV,
1655 SURVEILLANCE, OIL TRANSFER, OIL SPILLS, NORTH SEA, ENVIRONMENTAL PROTECTION, TANKERS,
1689 SURVEILLANCE, REMOTE SENSING, OIL SLICKS, OCEANS, *DYS/SLICK SEAMARKING DEVICE,
1694 SURVEILLANCE, SANTA BARBARA CHANNEL, REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, DETECTION, *COASTAL ZONE COLOR SCANNER,
1734 SWEDEN, SPILL CONTAINMENT, PORTS, TANKERS, *SPILL BUBBLE BARRIER,
1745 SWEDEN, OIL TANKS, CLEANUP, *TANK CLEANING STATION,
2123 SWEDEN, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, EPA, *BALTIC CONVENTION,
1640 TANKERS, SPILL CLEANUP, LIABILITY, ARGO MERCHANT SPILL,
1641 TANKERS, POLLUTION PREVENTION, MOVEMENT, MONITORING, ARGO MERCHANT SPILL, USGS,
1646 TANKERS, SAFETY, OIL SPILLS, ECONOMICS, *LIBERIAN REGISTRY,
1655 TANKERS, SURVEILLANCE, OIL TRANSFER, OIL SPILLS, NORTH SEA, ENVIRONMENTAL PROTECTION,
1660 TANKERS, SPILL CLEANUP, OLYMPIC GAMES SPILL, DELAWARE, BIRDS, *DELAWARE RIVER,
1661 TANKERS, OIL SPILLS, *LIBERIAN REGISTRY, *FLAGS OF CONVENIENCE,
1662 TANKERS, STATISTICS, OIL SPILLS, OCEANS, *TANKER ACCIDENTS,
1680 TANKERS, REGULATIONS, PATENT, OIL DISCHARGES, MONITORING, DESIGN-ENGINEERING,
1731 TANKERS, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OFFSHORE DEVELOPMENT, NATURAL SEEPAGE, INTERNATIONAL AGREEMENTS,
1734 TANKERS, SWEDEN, SPILL CONTAINMENT, PORTS, *SPILL BUBBLE BARRIER,
1766 TANKERS, SPILL CLEANUP, PATENT, LEAKAGE, *OIL SOLIDIFICATION,
1795 TANKERS, STORAGE, FEA, ENVIRONMENTAL PROTECTION, CRUDE OIL,
1796 TANKERS, STORAGE, PATENT, DESIGN-ENGINEERING, *OIL STORAGE TANK,
1801 TANKERS, SAFETY, OIL TRANSPORT, *STANDARDS, *ACCIDENT PREVENTION,
1889 TANKERS, POLLUTION PREVENTION, OIL TANKS, OIL SPILLS, *TIN CAN CONTAINERS,
1896 TANKERS, SPILL RECOVERY, POLLUTION PREVENTION, PIPELINES, OIL TRANSPORT,
1902 TANKERS, SAFETY, POLLUTION CONTROL, OIL SPILLS, OIL DISCHARGES, LIABILITY, INTERNATIONAL CONVENTIONS,
1988 TANKERS, OIL SPILLS, OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, *SPILL SUPERFUNDS,
1989 TANKERS, REGULATIONS, PORTS, OIL TRANSFER, OIL SPILLS, LIABILITY, ALASKA, *OIL SPILL FUND,
1992 TANKERS, OIL SPILLS, LEGISLATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CANADA,
1994 TANKERS, OIL SPILLS, ENVIRONMENTAL EFFECTS,
1995 TANKERS, OIL SPILLS, MALAYSIA, ENVIRONMENTAL EFFECTS,
2110 TANKERS, STATE GOVERNMENTS, POLLUTION CONTROL, OIL SPILLS, LEGISLATION, US,
2111 TANKERS, REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, US,
2112 TANKERS, SEGREGATED BALLAST , REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL DISCHARGES, EIS, US,
2113 TANKERS, SEGREGATED BALLAST , REGULATIONS, ENVIRONMENTAL PROTECTION, USCG,
2114 TANKERS, REGULATIONS, OIL DISCHARGES, WASTEWATERS, USCG,
2120 TANKERS, SAFETY, REGULATIONS, PORTS, LAW ENFORCEMENT, GOVERNMENT AGENCIES, USCG,
2122 TANKERS, POLLUTION PREVENTION, MANUALS, GUIDELINES, CONTINGENCY PLANNING,
2126 TANKERS, OIL DISCHARGES, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, IMCO,
1648 TAR, SARGASSO SEA, OCEANS, DISTRIBUTION, CANADA, ATLANTIC OCEAN,
1700 TAR, SAMPLING, DISTRIBUTION, BERING SEA, ALASKA/GULF OF, *PLASTICS,
2036 TAR SANDS, EXTRACTION, ENVIRONMENTAL PROTECTION, DEVELOPMENT , CANADA, *ALBERTA,
2040 TAR SANDS, PRODUCTION , OIL SHALE, FOSSIL FUELS , ENVIRONMENTAL EFFECTS,
1797 TEXAS, PIPELINES, OIL TRANSPORT, OIL SPILLS, EIS, CRUDE OIL, ALASKA,
1882 TEXAS, SPILL CLEANUP, POLLUTION CONTROL, PERSONNEL TRAINING, *OIL SPILL CONTROL COURSE,
1666 TOXICITY, JAPAN, FISH, DISPERSANTS, TROPICAL REGIONS, *WARREN SPRINGS LABORATORY, *HONG KONG,
1746 TOXICITY, SPILL CLEANUP, SOLUTION, EMULSIFIERS, DISPERSANTS,
1770 TOXICITY, SPILL CLEANUP, SINKING AGENTS, DISPERSANTS,
1792 TOXICITY, SURFACTANTS, SOLVENTS, RESTORATION, OIL SPILLS, WILDLIFE,
1910 TOXICITY, OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS,
1913 TOXICITY, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BEHAVIOR, ANALYTICAL TECHNIQUES, *SUBLETHAL LEVELS,
1914 TOXICITY, FUEL OIL, CRUDE OIL, ALGAE,
1916 TOXICITY, SPILL CLEANUP, OIL DISCHARGES, MARINE ORGANISMS, DISPERSANTS,
1920 TOXICITY, CRUSTACEANS, CRUDE OIL, AROMATIC HYDROCARBONS , *LARVAL DEVELOPMENT, *CANCER MAGISTER,
1921 TOXICITY, POLYCHAETES, FUEL OIL, CRUDE OIL, *REPRODUCTION,
1926 TOXICITY, CRUSTACEANS, CRUDE OIL, *MISSISSIPPI SOUND, *COPEPODS,
1930 TOXICITY, PLANTS, CRUDE OIL, CONTAMINATION, *OLNEY BULRUSH, *MARSHHAY CORDGRASS,
1932 TOXICITY, SURFACTANTS, FISH, DISPERSANTS, BIOLOGICAL EFFECTS,
1934 TOXICITY, ECHINODERMS, DISPERSANTS, *ESSO COREXIT 9527, *FERTILIZATION,
1938 TOXICITY, FISH, CRUDE OIL, CHRONIC EFFECTS, *TROUT REPRODUCTION,
1940 TOXICITY, PLANKTON , OCS, NEW YORK, CRUDE OIL, BENTHOS, *NEW YORK BIGHT,
1942 TOXICITY, PETROLEUM PRODUCTS, METABOLISM, FISH, *SPICARA SMARIS, *SOLEA LASCARIS NASUTA,
1943 TOXICITY, PETROLEUM PRODUCTS, FISH, *HEMATOLOGICAL CHANGES,
1946 TOXICITY, REFINERIES, MONITORING, INVERTEBRATES, FRESHWATER, WASTEWATERS, *DAPHNIA PULEX, *BIOASSAY,
1948 TOXICITY, PHYTOPLANKTON, ESTUARIES, CRUDE OIL, *KUWAIT CRUDE,
1949 TOXICITY, LUBRICATING OIL, FRESHWATER, FISH, CHRONIC EFFECTS, *SYNTHETIC OIL,

1955 TOXICITY, PETROLEUM PRODUCTS, GASOLINE, FRESHWATER, CRUDE OIL, BIODEGRADATION, BACTERIA, ALGAE, *PHOTOSYNTHESIS,
1962 TOXICITY, RELEASE, MARINE ORGANISMS, FUEL OIL, CRUDE OIL, UPTAKE,
1963 TOXICITY, METABOLISM, HYDROCARBONS, FUEL OIL, FISH, CRUDE OIL,*RESPIRATION, *ONCORHYNCHUS GORBUSCHA,
1964 TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS, CRUDE OIL, *COMPARATIVE TOXICITY , *BIOASSAY,
1965 TOXICITY, SURFACTANTS, MOLLUSKS, HYDROCARBONS, EMULSIFIERS, CRUDE OIL, BIBLIOGRAPHIES, *MUSSELS,
1970 TOXICITY, ALGAE, *REPRODUCTION,
1972 TOXICITY, HYDROCARBONS, FISH, *BENZENE, *REPRODUCTION, *CLUPEA HARENGUS PALLASI,
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DAVIDSON, F.M. 1704
DAVIS, G. 1695
DAVIS, R.W. 1986
DAWE, L.L. 1719
DENEKE, F. 1673
DE PRATER, B.L. 1846
DEUTSCH, H. 1691
DIBBLE, J.T. 2064
DICK, S. 1674
DICKS, B. 1793
DIETZ, A.S. 1923
DONALDSON, E.C. 1863
DOOLITTLE, J.C. 1898
DORRLER, J.S. 1899
EARHART, J.P. 1816
EARHART, J.P. 1817
ELLIOTT, H.A. 2084
ENG, J. 1834
ENGELHARDT, F.R. 1924
ENKE, C.G. 1768
ENVIRON. PROTECTION SERV. 2121
EPA 1692
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EPA 1900
EREDITARIO, J.M. 1925
ESTES, J.E. 1691
EVEMIN, V.I. 1702
FAGO, E.T., JR. 1674
FAIN, G.D. 1926
FALK, M.R. 2036
FARN, R.J. 1770
FAY, F.H. 2037
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FEBEN, J.C. 1796
FEDERLE, T.W. 1980
FINDLEY, J.E. 2065
FONTANA, M. 1985
FOSTER, M.S. 1927
FRIES, B.A. 1819
FRIES, C.R. 1928
FRIEYRO, O. 2066
FUCIK, K.W. 1929
FUKUHARA, O. 1979
GABSCH, K. 1837
GALAYEV, Y.M. 1693
GARRETT, W.D. 1689
GASANOV, M.V. 1820
GASSMANN, G. 1821
GATELLIER, G.C. 1916
GEBHART, J.L. 1930
GERACI, J.R. 1924
GERAGHTY, J.J. 1729
GERARD, F. 2000
GESSER, H.D. 2088
GIBBS, C.F. 2067
GIBSON, D.T. 2068
GILES, R.C. 1931
GLENN, M.C. 1682
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GLOYNA, E.F. 1871
GONGAWARE, W. 1684
GOODSON, L.H. 1674
GORDON, D.C., JR. 1708
GORNITSKII, A.B. 1778
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GRAHAM, B. 1949
GRAHAM, D.J. 1736
GRAHL-NIELSEN, O. 2093
GRANMO, A. 1932
GREENSHIELDS, J.N. 1765
GRIFFIN, W.M. 2069
GROENEWOUD, W.M. 1802
GRONLUND, W.D. 1938
GROSE, P.L. 2001
GRUGER, E.H., JR. 1933
GRUTSCH, J.F. 1822
GUDASHEVA, V.M. 1823
GUMP, B.H. 1714
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GUNDLACH, E.R. 1656
GUNKEL, W. 1821
HAGIWARA, M. 1824
HAGSTROM, A. 2094
HAGSTROM, B.E. 1934
HALE, L.C. 1825
HARRALD, J.R. 1657
HARRIS, J.O. 1771
HARRIS, R.P. 1915
HARRIS, R.P. 1935
HARRISON, E.A. 2128
HARTMANN, R. 1772
HASLEDON, J.D. 1811
HATER, G.R. 1980
HAWKES, J.W. 1936
HAWKES, J.W. 1938
HAYES, M.O. 1656
HEATH, J.E. 1826
HEIN, M. 1827
HELLMANN, H. 1955
HERSHNER, C.H. 1937
HERTZ, H.S. 1714
HERTZ, H.S. 1725
HILDRETH, R.G. 2109
HIRANO, T. 1858
HIRANO, T. 1859
HIRATA, T. 1787
HOBBS, J.R. 1877
HOCUTT, C.H. 1952
HODGINS, H.O. 1938
HOKETSU, H. 1773
HOKETSU, H. 1828
HOLLAND, W.F. 2039
HOLMES, R.W. 1927
HOROWITZ, A. 2070
HOROWITZ, A. 2071
HOROWITZ, A. 2072
HOULIHAN, T.M. 1675
HOULIHAN, T.M. 1684
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HOVIS, W.A. 1694
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HUDSON, M. 1658
HUFFORD, G.L. 2095
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HUGHES, D.E. 2073
HUGHES, P. 1676
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HUNDEMANN, A.S. 2130
HUNDEMANN, A.S. 2131
HUNDEMANN, A.S. 2132
HUNT, L.L. 2089
HYDE, B. 2055
IGNATIADES, L. 1939
IKEGUCHI, M. 1829
IL'INSKII, V.V. 2080
IMCO 2122
IN'T VELD, C. 1737
IRONS, D.E. 1774
ISHIMARU, E. 1866
IVANENKO, A.P. 1868
IYENGAR, M.S. 1878
JACKSON, J.L. 2134
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JACOBSON, J.P. 2038
JANSON, D. 1659
JANSON, D. 1660
JEFFREY, P.G. 1775
JEFFRIES, H.P. 1940
JEHL, J.R., JR. 1941
JENKINS, D.M. 1990
JENKINS, R.G. 1679
JENKINS, R.G. 1713
JENKINS, T. 1673
JOHN, C.B. 2021
JOHNSON, L. 1673
JOHNSON, R.E., JR. 1830
JOHNSON, W.C., II 1940
JOHNSTON, M.H. 1957
JOHNSTON, R. 2002
JOHNSTON, R. 2003
JONES, D.C. 2039
JONES, D.R. 1694
JONES, J.A. 1831
JOUVE, P. 1901
KALMYKOV, A.I. 1693
KAWAMORI, M. 1832
KAPLAN, I.R. 1722
KARINEN, J.F. 1953
KARINEN, J.F. 1962
KARINEN, J.F. 1964
KARINEN, J.F. 1975
KATAI, J. 1665
KAUWLING, T.J. 2133
KAWAGUCHI, N. 1833
KAWAKAMI, N. 1829
KAWASE, Y. 1879
KAWASE, Y. 1880
KAYAMA, M. 2106
KEIZER, P.D. 1708
KELLEY, R.F. 2021
KEMPLING, J.C. 1834
KENDRICK, P.J. 1886
KHAIMOVICH, B.N. 1835
KIELI, J. 1836
KIESSER, S.L. 1912
KIFNER, J. 1661
KIFNER, J. 1662
KILVINGTON, C.C. 1935
KINDER, R. 1837
KING, C.J. 1816
KING, C.J. 1817
KING, E.M. 1663
KING, K.I. 1699
KIRILLOVA, L.M. 1820
KISHIMA, T. 1824
KLEINMAN, B. 1664
KLEMAS, V. 1695
KOBLANSKI, J.N. 1838
KOBYZEV, N.P. 1835
KOKOVKINA, T.F. 1864
KOLLBERG, S. 1932
KOOYMAN, G.L. 1986
KOTOV, A.M. 1942
KOTOV, A.M. 1943
KOVACS, A. 2096
KOZARAC, Z. 1707
KOZARAC, Z. 1726
KREBS, C.T. 1944
KUBELKA, V. 1709
KUMITOMO, Y. 1776
KUNZ, D.A. 2074
KUREKIN, A.S. 1693
KUZ, O. 1772
LACAZE, J.-C. 1948
LACKIE, J. 1695
LACY, J.C. 2039
LAKATOS, G. 1865
LANDRY, M.J. 2044
LA POINTE, A.E. 2021
LARRABEE, R.M. 1789
LARSON, D.W. 2056
LARSON, R.A. 2089
LASETER, J.L. 1710
LASETER, J.L. 1717
LAUGHLIN, R.B., JR. 1945
LAWRENCE BERKELEY LAB. 1677
LEBEDEVA, E.S. 1682
LE BLANC, L. 1665
LEE, D.R. 1946
LEE, R.F. 1947
LEE, R.F. 2097
LEE, W.T. 1711
LEGENDRE, M.C. 1710
LEIBOVICH, S. 1738
LEITZELL, T.L. 1902
LEMENTA, Y.A. 1693
LE PEMP, X. 1948
LICHTENTHALER, R. 1728
LINDSAY, R.C. 1712
LI, W.K.W. 1958
LISSAUER, I.M. 2095
LISSAUER, I.M. 2098
LOBOV, L.I. 1702
LOCK, J. 1839
LOCKHART, W.L. 1949
LOGAN, W.J. 1905
LONNING, S. 1934
LOYA, Y. 1950
LUKAS, L.A. 1721
LUKMANOV, YU.KH. 1781
LUMPKINS, R.J. 1813
LUZAK, J. 2006
LYNCH, M.P. 2038
LYNCH, W.M. 1845
LYSYJ, I. 1840
LYTLE, J.S. 1678
LYTLE, T.F. 1678
MAC ARTHUR, G.P.S. 2012
MAC LEOD, W.D. 1679
MAC LEOD, W.D., JR. 1713
MADSEN, O.S. 2104
MAKAROVA, G.D. 2092
MAKI, H. 1866
MALESZEWSKA, J. 2006
MALINA, J.F., JR. 1871
MALINS, D.C. 1951
MALINS, D.C. 2076
MALLATT, R.C. 1822
MALLON, M.H. 1920
MANNING, F.S. 1863

MANOWITZ, B. 2042
MAPCO, INC. 1841
MAR. POLLUTION INFO. CENTRE 2004
MASNIK, H.T. 1952
MASUDA, M. 1859
MATTSON, J.S. 2001
MAY, W.E. 1714
MAY, W.E. 1725
MAYER, A.J. 1801
MC AULIFFE, C.D. 2085
MC AULIFFE, C.D. 2099
MC CARTNEY, J.K. 1881
MC CORMACK, M.M. 2040
MC CORMICK, J.H. 2127
MC DERMOTT-EHRLICH, D. 2041
MC DONALD, S. 2075
MC FADDEN, T. 1673
MC GRATH, F.K. 1675
MEARNS, A.J. 2133
MECKLENBURG, T.A. 1953
MECKLENBURG, T.A. 1962
MEURER, R.W. 2021
MICHAEL, A.D. 2005
MIGHELL, J.L. 1938
MIKHALEVA, I.M. 2107
MIKSCH, K. 1842
MILKOWSKA-JANKOWSKA, D. 2006
MILLER, D.W. 1729
MILLER, J.C., JR. 2044
MILLER, M.C. 1980
MIMICOS, N. 1939
MINCHEW, C.D. 1954
MIRANDA, J.G. 1843
MIRONOV, O.G. 1715
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MISCH, C.J. 1962
MITERA, J. 1709
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MOE, P.G. 1847
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MOORE, G. 2115
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MOORE, L.J. 1912
MOREAU, J.O. 1680
MORGAN, J.E. 1845
MORI, M. 1824
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MOSS, M.R. 1995
MOSTECKY, J. 1709
MOTOMURA, H. 1856
MOULDER, D.S. 2136
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MUMPHREY, A.J., JR. 2044
MURATA, K. 1777
MURRAY, D. 1949
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MURZAKAEV, F.G. 1903
MYERS, L.H. 1846
NAGATA, Y. 1829
NAGY, A. 1865
NAKAGAKI, H. 1829
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NAMMINGA, H.E. 1681
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OBARA, G. 1849
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O'HARA, S.C. 1915
O'HARA, S.C.M. 1935
OKHORI, K. 1780
OKUMURA, M. 1850
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PARSONS, T.R. 1958
PAUL, A.J. 2102
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PAYNE, J.F. 1959
PAYNE, J.L. 1883
PEAKE, E. 1718
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PELTON, P.M. 1845
PENROSE, W.R. 1719
PERCY, J.A. 1960
PERES, J.M. 1961
PETERS, H.H. 1806
PETROV, Y.M. 1981
PFAENDER, F.K. 1925
PFEFFER, F.M. 1846
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POLOVINKO, V.V. 1720
PONOMAREV, V.G. 1823
PORTE, P. 1782
PORTMANN, J.E. 2116
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POZDNYSHEV, G.N. 1781
POZDNYSHEV, G.N. 1852
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PREUS, P. 1853
PRONK, A.C. 1696
PUGH, K.B. 2067
QUENTIN, K.E. 1870
RADIAN CORP. 2050
RAMOS, L.S. 1713
READ, C.M. 1904
REED, W.E. 1722
REISH, D.J. 1921
REISH, D.J. 2133
RENAULT, P. 1916
RICCI, G.C. 2008
RICE, S.D. 1724
RICE, S.D. 1953
RICE, S.D. 1962
RICE, S.D. 1963
RICE, S.D. 1964
RILEY, R.T. 1699

RISEBROUGH, R.W. 2015
ROBE, K. 1860
ROBERTS, D. 1965
ROBERTSON, B.R. 2057
ROBISCH, P.A. 1933
ROBISCH, P.A. 1936
ROGERS, J. 1783
ROGIER, P. 1663
ROLAND, W. 1905
ROSEN, A.A. 1723
ROSENBERG, D.M. 1966
ROSS, S.L. 1905
ROSSI, S.S. 2133
ROUBAL, G. 2077
ROVEL, J.M. 1854
RUDIGER, C.E., JR. 1767
RUSSELL, E.C. 1840
SACKETT, W.M. 1671
SAETHER, O.A. 1966
SAIDA, T. 1776
SAKAGUCHI, S. 1979
SAKAKI, K. 1858
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SANDBROOK, R. 2125
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SCHAFFER, R.L. 1699
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SHCHEPANYUK, V.YU. 1668
SHECHTER, R.S. 1671
SHELTON, R.G.T. 2009
SHEPPARD, W.J. 1990
SHEPPARD, W. 2019
SHIBATA, H. 1833
SHINDLER, D.B. 1919
SHISHIDO, N. 1858
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SHMELEV, M.V. 1852
SHORT, J.W. 1724
SHORT, J.W. 1962
SHORT, J.W. 1963
SHORT, J.W. 1964
SHORT, T.E., JR. 1846
SIMONOV, A.I. 1682
SKAKUN, T.O. 2060
SKOCYPEC, R.J. 2126
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SKRYLEV, L.D. 1864
SKUJINS, J. 2075
SMAYDA, T.J. 1967
SMITH, A.W. 1860
SMITH, C.L. 2103
SMITH, D.C. 1792
SMITH, J.L. 1672
SMITH, J.O. 2134
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SMITH, T.G. 1924
SNYDER, H.L. 2051
SOC. GEN. CONS. ELEC. MEC. A. 1785
SONE, T. 1767
SORKIN, YA.G. 1861
SPEER, L. 1684
SPEHAR, R.L. 2127
SPIELMAN, L.A. 1862
STAFFORD, S. 2073
STAINKEN, D. 1968
STAMOCIDIS, V.C. 2091
STANG, P.R. 2055
STAUFFER, J.R. 1952
STEELE, R.L. 1969
STEELE, R.L. 1970
STEPHAN, C.E. 2127
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STOERMER, F.C. 2078
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STRAUGHAN, D. 1971
STRONG, A.E. 1691
STRUHSAKER, J.W. 1972
SUBAEVA, R.M. 1820
SUKAI, K. 1850
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SUKHOVERKHOVA, N.A. 1868
SU, Y.P. 1862
SUTTERFIELD, F.D. 1863
SUTTON, E.A. 1704
SVIRIDOV, V.V. 1864
SZABO, J. 1865
SZARO, R.C. 1973
TAKAHASHI, R. 1787
TAKEDA, N. 1866
TAKUEV, YU.S. 1682
TANIGUCHI, Y. 1856
TARATUNIN, A.F. 1835
TATEM, H.E. 1974
TAYLOR, T.L. 1975
TEAL, J.M. 1976
TEDESCHI, E.T. 1741
THOMAS, M.L.H. 1977
THOMAS, R.E. 1963
THOMAS, S.J. 2136
THOMPSON, B.D. 2095
THOMPSON, G.B. 1666
THYRUM, P.T. 1683
TITLOW, E.T. 1881
TOKAR, M. 1865
TOKUDA, H. 1978
TOLOKONNIKOVA, L.I. 2092
TOMITA, Y. 1867
TORNATORE, G. 1695
TOWNSLEY, P.M. 2079
TRENHOLM, S.R. 1699
TRIPP, M.R. 1928
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TSUCHIYA, H. 1858
TSUCHIYA, H. 1859
TSUNOI, I. 1788
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TUOMINEN, T. 1923
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VAN DER WAARDEN, A. 1802
VANHOOZIER, J.M. 1897
VAN KUILENBURG, J. 1697
VAN LOPIK, J.R. 2053
VASILENKO, I.I. 1868
VESTAL, J.R. 1980
VILLEDON DE NAIDE, O. 1948
VOKYO, Y.V. 1981
VON OERTZEN, J.A. 1982
VON PREEN, W. 1869
VSHIVTSEV, V.G. 1864

WADHAMS, P.	2086
WAGATSUMA, T.	1776
WAGEMANN, R.	1949
WAGNER, F.W.	2044
WAKEHAM, S.G.	1730
WALKER, B.	1765
WALKER, J.D.	2061
WALKER, J.D.	2062
WALL, C.J.	1812
WALTER, R.A.	1877
WANG, H.	2087
WARD, D.H.	2081
WARD, J.M.	1761
WARD, R.S.	1789
WARDLEY-SMITH, J.	1731
WARDLEY-SMITH, J.	1790
WARDLEY-SMITH, J.	1791
WARDLEY-SMITH, J.	1887
WARDLEY-SMITH, J.	1906
WARDLEY-SMITH, J.	1907
WARDLEY-SMITH, J.	2010
WARDLEY-SMITH, J.	2105
WATERS, R.	1958
WEIL, L.	1870
WEISBERG, E.	1855
WEKELL, M.M.	1933
WELLER, G.	2054
WELSH, J.P.	2095
WELSH, J.P.	2098
WESTLAKE, D.W.S.	2082
WESTRHEIM, K.	2093
WHELAN, W.	1695
WHITE, J.	1991
WIENS, A.P.	1966
WILDUNG, R.E.	1704
WILHELMSEN, S.	2093
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WILLIAMS, A.S.	1792
WILLIAMS, D.C.	2055
WILLIAMS, H.D.	1908
WILSON, J.H.	1952
WILSON, K.W.	1983
WINTERS, K.	1914
WISE, S.A.	1714
WISE, S.A.	1725
WON, K.W.	1816
WON, K.W.	1817
WONG, H.Y.	1817
WOODRUFF, D.L.	1912
WU, C.J.	1871
YAMADA, H.	2106
YANG, W.C.	2087
YARBROUGH, J.D.	1954
YEN, T.F.	2065
YEVICH, P.P.	1934
YOUNG, H.A.	1686
YOUNT, J.D.	2017
YUDITSKII, F.L.	1909
ZAGORSKI, K.	1872
ZINGULA, R.P.	2056
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ZUBEKINA, A.N.	2080
ZUTIC, V.	1707
ZUTIC, V.	1726
ZVONARIC, T.	1707

APPENDIX

Periodicals Reviewed

Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Applied Ecology Abstracts
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Komission fuer Meeresforschung
Biological Abstracts
Bioscience
British Birds
Bulletin of Environmental Contamination and Toxicology
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research
Ecolibrium
Ecological Abstracts
Ecological Modelling
Ecology Law Quarterly
Energy Information Abstracts
Energy Review
Environment
Environment Abstracts
Environmental Action
Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control
Environmental Periodicals Bibliography
Environmental Pollution
Environmental Science & Technology
Environmental Technology and Economics
EPA Reports Bibliography Quarterly
ERDA Energy Research Abstracts
Erdoel und Kohle Erdgas Petrochemie vereinigt mit Brennstoffchemie
Estuarine and Coastal Marine Science
Fuel Abstracts and Current Titles
Government Reports Announcements

Hydrocarbon Processing
IMS Newsletter
India Journal of Environmental Health
Industrial Wastes Information Bulletin
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Petroleum Abstracts
Iranian Journal of Science and Technology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health
Journal of Environmental Sciences
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Fisheries Review
Marine Geology
Marine Geotechnology
Marine Policy
Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Massachusetts Audubon
Microbial Ecology
National Fisherman
National Research Council, News Report
National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of Scientific Fisheries
Ocean Engineering
Ocean Industry
Ocean Management
Oceanic Abstracts
Oceanus
Offshore
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print

Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Sea Frontiers
Sea Secrets
Sea Technology
Selected References on Environmental Quality
Selected Water Resources Abstracts
Technical Book Review
The Ecologist
The Engineering Index
The Sciences
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Water, Air, and Soil Pollution
Water Pollution Control
Water Pollution Control Federation, Journal
Water Research
WRC Information
Western Fisheries

U.S. Environmental Protection Agency
Industrial Environmental Research Laboratory
Edison, New Jersey 08817

We are requesting your assistance upon receiving this report ("Oil Spill and Oil Pollution Reports, August 1977 - October 1977").

Is the information usable?
Is the format helpful?

We invite your comments and suggestions. Thank you.

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